CEREAL SCIENCE today

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AN OFFICIAL PUBLICATION
OF THE
AMERICAN ASSOCIATION
OF CEREAL CHEMISTS

OF INTEREST THIS MONTH

What can distilled monoglycerides do for these foods?

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THE VITAL STORY OF

Breakfast Cereals

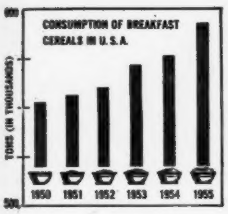
with essential vitamins and minerals restored

by Science Writer

New Edition

AMERICA LIKES BREAKFAST FOODS

Let no one doubt the popularity of breakfast cereals among Americans. The chart below traces the consumption of these fine foods between 1950 and 1955. During that period annual consumption rose by *76,000 tons*. In just one year, 1955, Americans ate 2½ lbs. of hot and 4.8 lbs. of cold cereals per person!



Why are breakfast cereals so well-liked? They are tasty; they are easily served; they appeal to busy homemakers, as well as institutional dietitians, because they are readily available in a variety of flavors at a modest cost. They add interest and value to an important but sometimes neglected meal—breakfast. Their use is extending to between-meal and party snacks, too.

Many grains are processed to make breakfast cereals: wheat, corn, oats, rice. Eaten with fruit and milk or light cream, they contribute an excellent combination of basic, flavorful, nutritious foods to the diet.

Better Foods for Better Health Through Restoration

The science of nutrition has advanced rapidly. In the manufacturing process of some cereals, some of the essential "B" vitamins and minerals are subject to some loss, just as with other foods. These losses are inescapable when such grains are prepared for human use. When this became known, manufacturers acted to overcome the losses. They adopted restoration.

Restoration simply means that certain important vitamins and minerals are restored to the cereal food during processing, so that the vitamin and mineral values in the finished product are generally equal to the whole grain values of those elements. Wheat, corn and rice products are customarily so treated. Vitamins B_1 (thiamine), B_2 (riboflavin), niacin (another "B" vitamin), and the mineral, iron, are those most widely restored. Vitamins C and D are also sometimes added.

Pre-sweetened cold cereals emphasize the nutritional importance of added vitamins. Increased calories require more "B" vitamins for best utilization of the food.

Why the Vitamins are Important

Physicians and diet experts have proved that vitamins are essential to prevent certain deficiency diseases and to contribute to robust good health.

Vitamin B_1 (thiamine) helps build and maintain physical and mental health. It is essential for normal appetite, intestinal activity, and sound nerves. A lack of this vitamin leads to beriberi, a rarity in the U. S. A., but still a very serious health problem in other parts of the world.

Vitamin B_2 (riboflavin) is essential for growth. It helps to keep body tissues healthy and to maintain proper function of the eyes.

Niacin is needed for healthy body tissues. Its use in the American diet has been largely responsible for the virtual disappearance of pellagra, a serious disease.

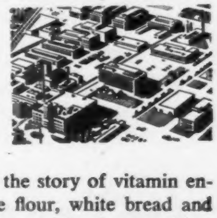
Vitamin D helps children develop normal teeth and bones. It prevents the development of certain abnormal bone conditions in adults.

Iron is essential for making good red blood and for the prevention of nutritional anemia.

Where Do the Vitamins Come From?

At about the same time that processing losses in breakfast cereals became known, other developments in the scientific world made available ample supplies of vitamins at economical prices. Thus, the nutritional contribution of some breakfast cereals could be, and was, greatly improved through restoration.

Since the early days of breakfast food restoration and of white flour and white bread enrichment, the world-famous firm of Hoffmann-La Roche has supplied top quality vitamins *by the tons.* Pioneering work in its laboratories and by its collaborators resulted in the "duplication" of some of nature's extremely complex substances. First, the chemical composition of the vitamin was learned. Second, the pure substance was isolated. Third, the "duplicate" was made by synthesis. And fourth, the laboratory techniques were extended to large scale commercial operations.



The manufactured "duplicate" is identical chemically and in biological activity with nature's own product. A vitamin is still a vitamin regardless of whether nature or man made it. So efficient is large-scale manufacturing, that vitamins are sold at a lower cost than if they were extracted from natural sources.

This article is one of a series devoted to the story of vitamin enriched or restored cereal products: white flour, white bread and rolls, corn meal and grits, macaroni products, white rice, breakfast cereals, farina. Reprints of this article, of any other in the series, or of all are available without charge. Please send your request to the Vitamin Division, Hoffmann-La Roche Inc., Nutley 10, New Jersey. In Canada: Hoffmann-La Roche Ltd., 1956 Bourdon Street, St. Laurent, P. Q.

LETTERS to the editor

DIASTATIC ACTIVITY: INCONSISTENCIES

DEAR SIR:

During the recent AACC convention at Cincinnati there was considerable conversation about inconsistencies noted during the past crop year among the various methods for determining diastatic activity in flour. It was suggested that someone be encouraged to prepare something along these lines for publication. Mr. Gerhard Wiens, International Milling Co., North Kansas City, Mo., has at my request submitted the information given below on such inconsistencies as were encountered in the Southwest with the 1957–1958 crop, under the customary methods of determining diastatic activity. It is felt that bakery chemists and others who may be unfamiliar with the problems of millers will appreciate having this matter brought to their attention.

It has been observed in wheats from a certain area for the past few years that there are discrepancies in the various methods for measuring enzyme activity and that these wheats do not respond to malt treatment with corresponding increases in gassing power and maltose content, but that in certain instances they respond with marked changes in amylograph characteristics. This presents a problem where a mill is required to meet certain gassing power or maltose specifications.

If gassing power or maltose content is used as an indication of optimum malting level, when sufficient malt is added to get either of these values up to more or less established specifications, the baking quality is impaired. It has been found under certain circumstances that the amylograph seems to give better indication of optimum malting level than either of the other two methods. Following are data on two samples of flour (Table I). Sample A shows expected relationship between the various methods for measuring enzyme activity and various increments of malt as correlated with baking quality. Sample B shows similar data on a sample which does not respond readily to malt addition by corresponding changes in gassing power and maltose content. The amylograph data, however, show relationship between enzyme activity and baking quality.

TABLE I

AMYLOGRAPH DATA

Malt	Gassing Power	Maltose	Amylograph	Baking Quality
%	*mm*	*mgm*	*B U*	
		Flour A		
None	455	237	(Off chart)	....
0.2	510	301	715	Good
0.4	551	347	555	Very good
0.6	610	392	480	Good
0.8	665	420	430	Fair
		Flour B		
None	351	188	(Off chart)	....
0.2	434	238	830	Good
0.4	467	265	600	Very good
0.6	481	302	485	Good
0.8	496	334	435	Fair

For the types of flour illustrated by Sample B which do not respond by marked changes in gassing power and maltose content to increments in malt addition, it is evident that other methods of testing for enzyme activity should be used.

The above examples clearly illustrate the hazards of setting rigid specifications for enzyme supplementation in terms of any given method of measurement other than the baking test, which is the final criterion of quality. These other methods are all valuable as control measures, but each has its limitations and can only be used after proper levels have been established by experimentation.

R. K. DURHAM

Pillsbury Mills, Inc.

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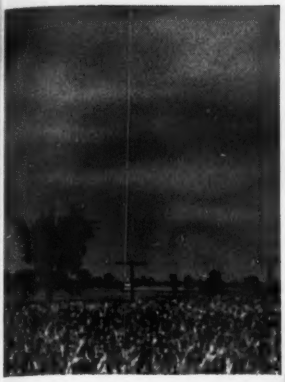

CEREAL SCIENCE *today*

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COVER: A Minnesota harvest scene. Photographed by Wesley E. Madsen.

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Editorial

THE STORY OF the three blind men examining an elephant illustrates the point that something may look very different to different individuals, depending upon the side from which it is viewed, whether seen close up, or from a distance. Even one's previous experience colors the image he perceives. It is quite likely that the American Association of Cereal Chemists does not appear exactly the same to any two of the twelve hundred members or to others acquainted in some degree with the organization.

On page 191 in this issue there appears an article entitled "The AACC's Role in the Cereal Industry." From his vantage point as its President, the author, Mr. Clinton L. Brooke, is aware, as few others can be, of the variety of activities through which the AACC seeks to broaden the knowledge and aid the professional growth of its members. It will be of interest to many to learn something about how national meeting sites are selected and what sort of problems arise in preparing a technical program. The AACC welcomes the encouragement and support of corporate members who may expect to profit from technological progress catalyzed by the Association. But the organization is composed primarily of individuals, and it is these individuals who staff its many technical committees and through group cooperation provide direct and important benefits to their employers and to the cereal industry in general. Naturally these technical activities also broaden the individual professionally and add to his competence as a cereal chemist.

Of special interest in this article is the tabulation of activities in which the membership is employed. Here is evidence of the diversity of specialization within a group that shares a common interest in the technology of processing cereal grains. We believe Mr. Brooke's article deserves to be read, not only by AACC members, but also by nonmembers eligible for membership, and by the employers of both these groups.

PAUL E. RAMSTAD

MICROSCOPIC ANALYSIS IN

Quality Control of Protein Feedstuffs

By Albert J. Gehrt,* Moorman Manufacturing Co., Quincy, Illinois

It is a well-known fact that the tremendous advances in livestock production during the past decade have resulted from three major factors: 1) improvement in animal breeding, 2) improvement in the nutritional value of feeds, and 3) effective control of animal diseases. Feed manufacturers are making every effort to include in their products all of the required nutrients in nutritionally available form and to eliminate from the feed any material which does not contribute to its feeding value.

Proper quality control in the modern feed plant is based on adequate analysis of the incoming raw materials so that as much as possible can be learned regarding their composition. Microscopic inspection possesses the very significant advantages of enabling detection and identification of undesirable or improperly processed ingredients which are not disclosed by conventional chemical methods. For example, the crude protein analysis of an animal protein feedstuff, such as meat scrap, is a measure of its total protein content but tells nothing about its quality or potential nutritional value. Although high in crude protein, overheated meat tissue and such contaminants as hoof and hair are relatively indigestible, hence their protein is of little or no value to the animal. Under microscopic inspection these undesirable ingredients are easily recognized. Furthermore, it is possible for the experienced microscopist to make a fairly accurate estimate of the quantities of the constituents in question. An additional advantage of microscopic analysis is its speed. Whereas a chemical determination requires at least several hours, the microscopic inspection is usually completed within a few minutes.

Equipment and Techniques

The equipment used in the microscopic inspection need not be expensive, since the particle size of most feedstuffs in mixed feeds is fairly coarse. Therefore, low magnification, usually not more than 20×, is sufficient. In our laboratory a low-power stereoscopic microscope capable of magnifications from 4 to 32× is used.

Application of microscopy to quality control is based on a study of the normal as well as the undesirable constituents of the various feedstuffs, so that each may be identified easily in routine microscopic inspection of subsequent samples. In the study of a feedstuff suspected of containing abnormal constituents, it is usually desirable at the start to isolate the offending materials so that they may be examined and perhaps photographed in relatively pure form. This is done in several ways. One method is to treat the sample with a reagent or reagents which will dissolve the nutritionally available portion, leaving the insoluble or indigestible components as a residue.

Crude Fiber

A common technique that is very effective, especially for vegetable proteins and carbohydrate feedstuffs, is the conventional crude fiber procedure (1), which consists of treatment of the sample with acid followed by alkali. After the alkali treatment the undissolved residue is washed with water and alcohol. It can then be dried and studied microscopically.

In the six low-power photomicrographs, the two at left show feeding oatmeal (A) and crude fiber residue from this product (B). In B, the complete absence of the floury portions of the oat groat is quite apparent.

Pepsin Digestion

A more recent method which has become very useful in isolating the indigestible constituents of animal protein feedstuffs is the pepsin-digestion method (3,4), which simulates the action of the gastric juice in the animal, leaving an indigestible residue well suited to microscopic examination.

An inferior quality meat scrap (C) and the pepsin-indigestible residue from this sample (D) are also shown (center). The latter is composed of 1) undigested feed from the animal paunch or stomach which appears as rough, fibrous, light straw-colored pieces; 2) yellow, amber, or black translucent, chunky hoof particles; 3) rodlike pieces of hair of varying fineness ranging from light tan to black; 4) chunky cinderlike particles of scorched meat; and 5) light-brown pieces of slightly overcooked meat tissue with little or no characteristic structure. Close inspection of the meat scrap photograph (C) reveals the presence of these indigestible components.

Flotation

A third method for separating the various constitutents of a feedstuff is based on differences in specific gravity of its components. It is accomplished by selecting solvents of appropriate densities which float the lighter particles while permitting the heavier ones to settle to the bottom. This method does not differentiate between the digestible and indigest-

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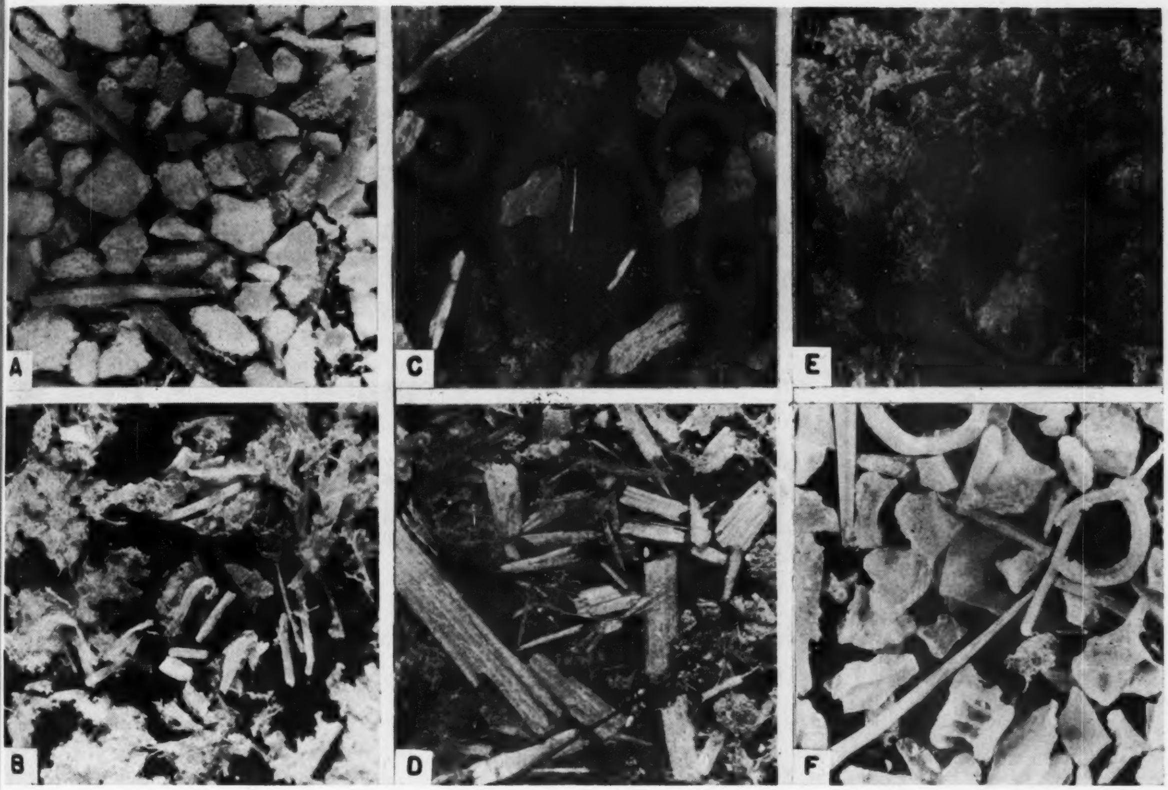
* Presented at the 43rd annual meeting, Cincinnati, Ohio, April 1958.



ow-power photomicrographs of feedstuffs ($\times$ 7.5). A, feeding oatmeal. B, crude fiber from feeding oatmeal showing complete absence of floury portions of the oat groat. C, meat scrap, inferior quality. D, pepsin-indigestible residue from meat scrap of inferior quality showing undigested eed, hoof, hair, scorched meat, and slightly overcooked meat tissue. E, fish meal fraction lighter than carbon tetrachloride showing well-cooked fish tissue. F, fish meat fraction heavier than carbon tetrachloride showing flat translucent scales and characteristically shaped fish bones.

ible fractions. However, the various fractions may be subjected to digestion tests if desired. A simple application of the flotation technique is the separation of the bone and heavy constituents of meat scrap or fish meal from the tissue and light constituents.

The effectiveness of carbon tetrachloride flotation is demonstrated in photomicrographs (right): the bone-free light fraction from fish meal (E) contains only the cooked fish tissue. The fraction heavier than carbon tetrachloride (F) is seen to be completely free from tissue, containing only the slender, pointed or distinctively curved fish bones and scales. The separation of tissue from bone is an illustration of the flotation process and should not be regarded as an indication that bone is undesirable. Bone is an excellent source of calcium and phosphorus, both of which are vital to proper bone development in the animal.

Evaluating Contaminants

After the observer has become familiar with the appearance of the constituent being studied, a semiquantitative estimation of the amount present can be made by inspection, in terms of absent, slight, medium, heavy, or excessive. If a more precise evaluation is needed, particle-counting techniques (2) are available which yield more accurate results. These procedures are slower and more laborious than simple inspection.

Causes for Inferior Quality

The most common causes for inferior quality in feedstuffs are contamination, improper processing, and spoilage. Contamination results when the manufacturer does not eliminate from his product the undesirable constituents present in the raw material or fails to guard against the introduction of foreign matter. The more common contaminants of meat scrap, for example, are hoof, hair, and paunch content.

A second cause for inferior quality is over- or underheating. Most protein feedstuffs are heated during manufacture for the purpose of drying, sterilizing, increasing digestibility, decomposing undesirable constituents, etc. If overheated, however, the nutritional value may be impaired, as in the case of meat scrap or soybean oil meal where amino acid availability is apparently reduced. Insufficient heating frequently yields a product of too high moisture content which may undergo spoilage, such as mold development or spontaneous overheating during storage. Both the overheated particles and evidences of mold growth are easily detectable under the microscope.

Photomicrography

Photomicrography in both black-and-white and color (5) has become an important tool in our quality-control program. Photomicrographs of the various feedstuffs or fractions isolated from them have been very useful to our purchasing department in pointing out to a supplier the presence of undesirable constituents which are to be minimized or eliminated.

General Comments

In general, most of the raw materials received in our factory are

free from serious contamination. This is especially true of vegetable proteins. It is recognized that products such as soybean oil meal and cottonseed meal normally contain some hull. This is not particularly undesirable except insofar as it reduces the protein content and increases the crude fiber. Frequently the microscopic inspection will eliminate the need for a crude fiber determination, especially if the hull or fibrous portion of the sample is concentrated by flotation.

In the past six years since the start of our microscopic inspection program more improvement has probably been made in the quality of meat scrap than in any other raw material. At that time certain samples of meat scrap were found to contain considerable quantities of hoof, hair, paunch content, and overheated meat. Pointing out the presence of these undesirable constituents to our suppliers has enabled them to greatly improve the quality of their products. The combination of microscopic inspection with the pepsin-digestion technique has been especially valuable in this case.

Summary

As has been brought out in the foregoing discussion, the composition of feedstuffs is highly complex. Contamination, improper processing, or spoilage can greatly impair their nutritional value. Any analytical technique which is capable of detecting and identifying the causes of inferior quality can be an important tool in quality control, especially if it is rapid and inexpensive. Microscopic inspection, when used in conjunction with the more conventional physical and chemical methods of analysis, is fulfilling these requirements and is receiving wide acceptance in the feed industry and allied fields.

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PROJECTS AND PERSONNEL PRODUCING

Cereal and Baked Products for the Armed Forces

By Samuel A. Matz, Quartermaster Food and Container Institute for the Armed Forces, Quartermaster Research and Engineering Command, U. S. Army, Chicago, Ill.

SINCE RATION ITEMS served to personnel of the Armed Forces frequently must have special characteristics which commercial foods do not possess, development of items having these special characteristics constitutes an essential area of work for the Quartermaster Corps. Most of the research and development work on food products is performed under the direction of the Quartermaster Food and Container Institute for the Armed Forces. This organization, located in Chicago, is composed of the Container Division, the Radiation Preservation Division, and the Food Division. There are also some associated offices (e.g. the Statistical Office) not falling into one of these categories.

Branches and Their Functions

The Food Division includes several branches concerned with groups of commodities, or with nutrition, sensory perception testing, and fundamental research. One of the commodity groups is the Cereal and General Products Branch. This group performs or directs substantially all of the research and development work on cereal foods which is financed by the Department of Defense. It also functions extensively as a technical service group by providing advice and assistance in its special field to other Armed Forces organizations.

The Cereal and General Products Branch is staffed by both civilian and military personnel. Its operations are under the direction of Samuel A. Matz. Research activities on cereals and baked products by the Branch are headed by Velt Stafford, and the development functions in this area are headed by M/Sgt. Omer E. Mason. The General Products personnel are concerned with work on coffee and other beverages, dessert mixes, spices and flavors, etc.

Industrial Advisory Committees

Much assistance is received from industry in solving problems involved in adapting commercial foods to the special requirements of the Armed Forces. To facilitate this flow of information, industry advisory committees have been formed of technical people having experience in the production of important classes of foods. Members are appointed by the Quartermaster General. They are selected so that the committees will represent both large and small business as well as all of the major geographical areas.

Industry advisory committees on crackers, biscuits, and cookies, active dry yeast, canned steamed puddings, and prepared bakery mixes are functioning at the present time. Membership is shown in the accompanying table. The committees meet annually, or more frequently if desired, to offer advice to the Cereal and General Products Branch on specification and other problems. A member of the commodity section acts as the Government presiding officer at committee meetings.

Research and Development

Research and development work on cereal problems peculiar to the Armed Forces, or in fields where industry has little interest, is done by personnel of the Cereal and General Products Branch or by other organizations on a contract basis. As a general rule, fundamental research is performed outside the Institute, while applied research and development activities are "in-house." Outside research is usually performed by academic institutions, but other nonprofit organizations and even commercial firms may be asked to participate in this program. Contract research on cereal problems is currently being carried on by R. M. Sandstedt of the Uni-

Industry Advisory Committees

ACTIVE DRY YEAST

Howard Clark, Standard Brands, Inc.
Kenneth Frank, Red Star Yeast & Products Co.
R. J. Sumner, Anheuser-Busch, Inc.
S. C. Lutz, National Yeast Co.
J. D. Hanzsche, Federal Yeast Corp.

CRACKERS, BISCUITS, AND COOKIES

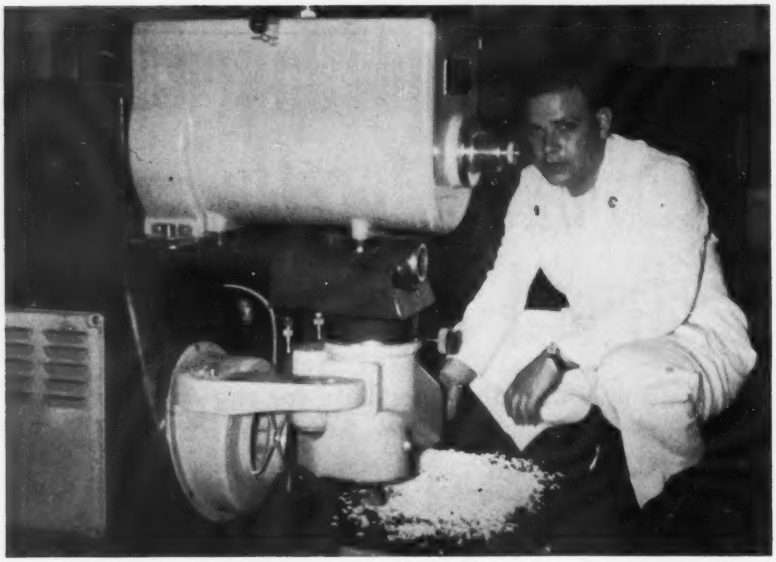
H. L. Williams, Griggs, Cooper & Co.
A. J. Brown, Schulze & Burch Biscuit Co.
J. C. Finley, Langendorf United Bakeries
R. K. Hower, National Biscuit Co.
H. J. Alleman, The Kroger Co.
James Larrimore, Sunshine Biscuits, Inc.
F. B. Leech, Zion Industries, Inc.
N. W. Moreth, Weston Biscuit Co.
G. F. Salerno, Salerno-Megowen Biscuit Co.
Carl Wortz III, Wortz Biscuit Co.
Maurice Affleck, Mother's Cake & Cookie Co.

CANNED STEAM PUDDINGS

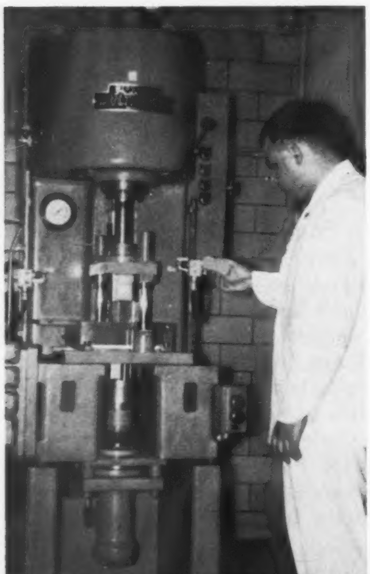
H. J. Alleman, The Kroger Co.
B. W. Clarke, Crosse & Blackwell
J. A. d'Avi, The Dromedary Co.
J. W. Hanley, Libby, McNeill, & Libby
Dougald McDonald, Burnham & Morrill Co.
J. D. Mullen, Otoe Food Products Co.

PREPARED BAKERY MIXES

C. G. Harrel, Pillsbury Mills, Inc.
J. S. Andrews, General Mills, Inc.
Zenas Block, Doughnut Corp. of America
R. C. A. Bradshaw, Quaker Oats Co.
Edward Feigon, Kitchen Art Foods
B. M. Dirks, Procter & Gamble Co.
J. L. McReynolds, General Foods Corp.
Betty Sullivan, Russell-Miller Milling Co.



Small automatic macaroni press used in developmental work on instant alimentary pastes.



versity of Nebraska, Lazare Wiseblatt of the American Institute of Baking, John A. Johnson of Kansas State College, W. F. Geddes of the University of Minnesota, and E. G. Bayfield of the Florida State University. A typical project is the isolation and identification of flavoring compounds from bread. Technical coordination of these contracts is the responsibility of a member of the Cereal and General Products Branch.

Assistance in evaluating and directing the research of the Cereal and General Products Branch is provided by a subcommittee of the National Research Council Subcommittee on Foods. At present, this subcommittee has as its chairman William Bradley of the American Institute of Baking, and the other members are Betty Sullivan of Russell-Miller Milling Company, Charles Frey, Lawrence Atkin of Standard Brands, Inc., James Evans of American Maize-Products Co., and John Shellenberger of Kansas State College.

One of the principal problems facing the Armed Forces is the formulation of foods having extreme resistance to storage deterioration. The Cereal and General Products Branch conducts research on causes of, and means of preventing, storage instability in flour, and other projects are concerned with providing a complete line of canned bakery foods. Much effort is also being directed toward simplifying food preparation methods so that less manpower will be needed for this function in combat areas. A typical example of such work is the development of an "instant" bread mix which does not require fermentation and which can be prepared with a continuous dough mixer and extruder, thereby eliminating many steps in the conventional breadmaking process.

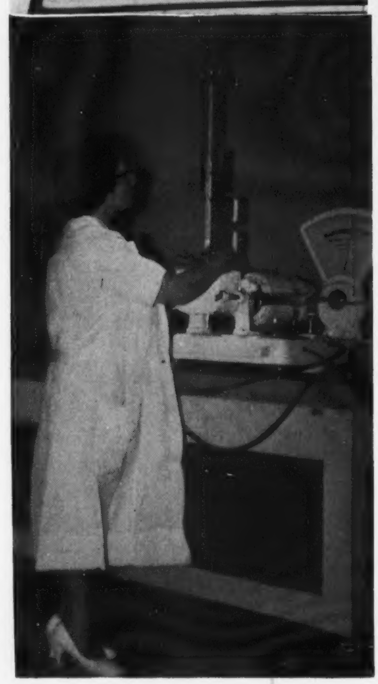
(Please turn to page 178)

Hydraulic press used to form cereal survival bars.

Dough mixer of half-barrel capacity for pilot-plant studies.

Large freeze-dryer used for preparing dehydrated bread slices.

Physical dough-testing instruments are available for investigational purposes.



A LABORATORY ADMINISTRATOR DISCUSSES

Practical Problems and Applied Research

By J. Ansel Anderson,* Chief Chemist, Grain Research Laboratory, Board of Grain Commissioners for Canada, Winnipeg, Manitoba

It is a privilege to revisit the Northwest Section of the AACC and a pleasure to see so many friends of long standing. My first visit to this Section was a good many years ago. Now I am older, but not wiser; for then I came to listen, whereas now I am so foolish as to come to talk—"Coals to Newcastle."

After choosing my subject, "Practical Problems and Applied Research," I asked myself this question, "*What is the most pressing practical problem facing the greatest number of us?*" I wonder what your answer would be; maybe you will find mine curious. For my answer is this, "*The problem of how to operate a laboratory effectively.*" All of us here are faced with this task; perhaps the operation of a large laboratory, or one of its sections, or a medium-large laboratory, or a small laboratory; perhaps a staff of over 100, perhaps 50, 15, or 5 — but still a problem. So let us discuss the operation of laboratories, dealing mainly with control laboratories and with the type of research most closely related to control operations.

The nastiest question that can be asked about such a laboratory is, "What does it control?" I once asked this question of the director of a large mill laboratory, not in your country or mine, and was greeted with a shocked silence. His eventual reply was, "Nothing. Nothing but the Dyox treatment, and that none too well." Of course, this was not actually so. He was exercising control by a feed-back process which caught a drift away from the desired quality before it became serious. Moreover, his backlog of data on variations in his wheat supplies and similar matters was most certainly guiding general policy. Nevertheless, the work of that laboratory dealt almost entirely with postmortems—with analyses made after products had been sacked and often after they had been shipped. We also do a lot of postmortems in our laboratory and perhaps you do, too, and will join me in saying that they have limited usefulness.

So what do you control? Or to put the question more accurately, What do you help to control in a major way? The wheat buying, the binning, the cleaning, the mill mix, the tempering, the milling operations, the divides, the grades, the treatments, the additives? What? Or put it another way: What percentage of your data is of major value, or of some or occasional value, or of little value, in the operations of your organization? Personally, I find it difficult to maintain a high batting average in this area.

Efficiency and Costs

Let us now take another question. How efficient is your laboratory? The end products of the laboratory operations are data. What are your costs per datum for each determination? How do they compare with the average costs in other laboratories? I have to admit that I do not know enough about the costs of all the individual determinations made in our Laboratory. We know the cost accurately for one or two determinations, roughly for others, and for some we know very little about costs. And the worst of it is, that we know least about the poorest or least efficient operations. But I think we do know which are the least efficient operations, and we are working quite steadily to improve them.

Let us break this subject down a little. The main item will be wages, and other important items will be materials, maintenance, supervision, and interest on capital investment. My general impression, as a result of travels through quite a few countries, is that many control laboratories fail to be reasonably efficient for lack of adequate investment in equipment. This comment does not apply to research laboratories, which seem to be loaded with all sorts of fancy instruments. But I am not talking about these, but about control laboratories. The point is this: you can afford a relatively large investment in equipment, if you can reduce the total cost by saving wages. A truism, of course, especially in the United States where automation is now progressing so rapidly.

There are two main ways to reduce the wage bill. The first involves time-saving devices that increase the output per man; and the second involves simplifications of the operations which make it possible to replace a skilled person by a semi-skilled person, or a semi-skilled person by an unskilled person.

Time-Saving Devices

As an example, I can cite the operation of our protein laboratory in which four persons do 480 determinations per day. This used to be very hard work, requiring speed, dexterity, and skill. It was considered the hell hole of the laboratory; the staff turnover was atrocious and the problem of training replacements was a continuous bugbear. We have recently rebuilt the laboratory and have

* Address to the Northwest Section of the AACC, Minneapolis, January 31, 1958.

incorporated a number of time-saving devices: pumps operated by push button switches to move all solutions; pre-set time switches on the digesting rack; magnetic stirrers in all titration flasks, and special burette stopcocks, which have the effect of making the titration a one-handed rather than a two-handed operation. In addition, the laboratory was designed to give a good flow of work so that the various technicians do not get in each other's way; and good ventilation was installed, though the room is by no means air-conditioned.

I think that the change in the titration operation has been as useful as anything. It has increased the speed of the expert titrator by 25% and has cut the training time for green staff by about 60%. The effect has been to take the strain off the staff. We have cut the wage bill, simplified the training problem, reduced turnover, and have a much happier group than we ever had before.

Perhaps I should stress the fact that I am not advocating the payment of low wages. We must pay professional salaries to professional people, and appropriate salaries to highly skilled and experienced technicians; indeed, everybody must be paid what the work is worth. But I am saying that it is wasteful to pay for more skill than is needed; this is just as important in the laboratory as elsewhere. Moreover, the matter is especially important today when so many countries are faced with a shortage of scientists and skilled technicians. We cannot afford to waste our good people when we could replace them with less skilled or even unskilled staff.

Good Maintenance

Another factor worth mentioning is maintenance. I am sure that many laboratories keep their equipment too long. It becomes out of date and badly worn. Every time repairs are required, there is a two- or threefold loss; the work is interrupted; it may even have to be repeated, which costs money; and there is the additional cost of the actual time and material used in the repairs. For my part, I am quite happy to see a research worker building equipment with baling wire and Meccano parts because he may require quite different equipment in a very short time. But when we are dealing with routine work that forms so large a part of a control operation, we require the very best and most reliable equipment that is available.

Accuracy and Precision

A further consideration of paramount importance in control is the accuracy and reproducibility of the results. And this costs money, especially when replication is involved to obtain the necessary degree of accuracy. The commonest fault in this area appears to be neglect of the sampling error. If the sampling error is large and cannot be reduced, duplicate determinations may not be warranted; for after all, duplicate determinations on a single sample are merely a measure of laboratory error which may well be negligible by comparison with the sampling error. This matter often requires extremely careful study; extensive statistical analyses may be required to decide whether single, duplicate, or quadruplicate determinations are warranted, and how these should be divided among single, duplicate, or quadruplicate samples.

Again, there is often the possibility of reducing replication and thus costs by increasing the precision of the test. I remember the time when we baked four loaves for every important sample in order to get a loaf volume that represented the mean of quadruplicates. By improving the control at all stages of the operation, mainly by introducing better equipment, we were able to cut our replication back to duplicates.

But this type of problem does not stay solved. In our Laboratory we have always used hand-molding for pup loaves, and this requires a really expert baker; for we have never been able to find a molding machine for pup loaves that matched the precision of an expert baker. At present, we are planning a substantial increase in the size of our baking section and are faced with the problems of costs and staff training. So we are having a third go at devising a satisfactory mechanical molder that will reduce the skill required in our baking operation. Our difficulty is to match the high standard set by our present bakers, but we seem to be succeeding. Our hope is that we can cut the cost of the operation while still retaining the accuracy we need.

None of this work is undertaken for fun, though, of course, it is fun. It is not a mere search for perfection, though I suppose that I tend to be a perfectionist. It is, I hope, a hard-boiled drive to get the required level of accuracy and precision at the lowest possible cost.

Thought and effort are required to develop a really efficient control operation. But the sort of thing I have been talking about is done with skilled technicians, with mechanics, electricians, plumbers — "the know-how boys."

Facts Alone Not Enough

There is another phase of efficient laboratory operation that you cannot undertake with technicians. It requires first-class professional brains; it requires not the "know-how" but the "know-why" types. This is the problem of deciding how to collect the most meaningful data for the purposes in mind. For it is never enough to collect mere facts; one must collect the facts of the case— the facts that are pertinent to the solution of the problem. This work rapidly shades into applied research, and we are increasing our staff in this area.

How do you test the milling and baking quality of a sample of wheat? What is the most effective and meaningful group of determinations? These are simple questions; and if you cannot answer them, perhaps you can hardly call yourself a cereal chemist. Well, I cannot answer them — to my own satisfaction. You see, I am not asking myself how many useful types of determinations I know, or whether I know how to interpret the data they yield. I am thinking in other terms; I am asking for the most efficient procedure for estimating the milling and baking quality of wheat, in terms of units of information per dollar of expenditure.

We are concerned with the most effective and efficient way of assessing the average quality of samples representing Canadian grades, or of following the changes in grade quality that occur from year to year, or of differentiating between varieties, or of assessing the effect on a given sample of a specific type of damage or treatment. We naturally know many determinations and test procedures that can be applied to these various problems; and we think we also know a good deal about interpretation of results of single procedures or of selected groups of procedures. We can

certainly say that we have an opinion about what it is best to do under given circumstances; but I do not think that we could demonstrate to our own satisfaction, and much less to the satisfaction of any group of cereal chemists such as this, that our selection of procedures is the best.

I must stress again that in Winnipeg our main problems relate to the testing of wheats, not flours. We are interested in flours only to the extent that they represent the wheats from which they are milled.

The fact that we are interested in wheats rather than in flours creates our major difficulty. For after all, there are comparatively few tests that can be made on wheat or on the meal that results when the kernels are ground: bushel weight, thousand-kernel weight, protein content, ash content, the Pelshenke test, and a few more. And all of these taken together are not adequate; one must mill the wheat into flour and test the flour. But how does one mill the wheat to obtain a representative flour, especially if one has only a few pounds of wheat?

Laboratory Milling for Wheat Testing

From the cereal laboratories that I have visited, it is not difficult to select two that exemplify entirely different philosophies of milling, and hence of wheat testing. I can think of one that I shall call "A," where the wheat is milled to about 60% extraction, and of another, that I shall call "B," where the wheat is milled to 75% extraction. Both laboratories use physical tests of dough properties as their main criteria of wheat quality. They have their own particular dough tests and their semantics, but we understand how to interpret their phraseology. Neither of them uses baking for normal routine studies of wheat quality.

Laboratory "A" mills to 60% and normally reports only negligible differences in strength between average samples of grades 1 to 4 Manitoba Northern. Laboratory "B" mills to 75% and normally finds considerable differences between grades, which are invariably placed in the order 1, 2, 3, 4 Northern.

In our Laboratory, we mill to about 72 to 73% when testing high-grade wheats. We also test the physical properties of dough, though we add baking tests. We frequently differ from both laboratories "A" and "B" when all of us are testing essentially the same set of samples. Now, we cannot all be right. Or can we? Perhaps we can.

Two Milling Philosophies

When laboratory "A" mills to 60%, it tests the basic inherent strength of the endosperm flour. And this is a very important characteristic, particularly in countries that are blending wheats obtained from various parts of the world in order to obtain a uniform mill mix and hence a uniform flour. Mills in these countries need to know the basic strength of the endosperm flour in order to design a suitable mix. In a sense, this form of testing is largely a qualitative assessment. It leaves out the quantitative factor. It does not tell how much flour of a given quality can be obtained from a given sample.

By contrast, laboratory "B" reports that if you mill to 75% extraction, you will have flour of the reported quality. The inference is that, if you need flour of better quality, you will have to use a lower extraction. But how much lower for a given degree of improvement in quality? This laboratory throws the milling characteristics of the wheat into the flour quality. The resulting data produce a sort of mixed quantitative and qualitative measurement. There is a good deal to be said for and against each of these philosophies of laboratory testing.

In our own Laboratory we may be worse than either "A" or "B." The difficulty is that our normal procedure involves milling in the extraction range in which flour quality is most affected by extraction rate. That is to say, we mill in the area of the maximum for the curve which plots loaf volume versus extraction rate. If we mill dead on the maximum for one sample and just below it or just above it for the next, the results of our tests of flour quality may be biased. But by how much?

At the moment, I am not optimistic about a final solution for this problem of laboratory milling for purposes of wheat testing, but there is good reason to expect improvement. The ideal might be to mill to a color standard, or even to a standard ash. But how? Both procedures would require a large increase in the amount of work on each sample. It would cost too much, and costs we can never forget.

As always, I suppose we shall have to seek a compromise. There is much to be said for the use of a low extraction flour representing the essential quality of the endosperm, but we should also like to add a quantitative assessment. Our present thought is that we may mill a flour of 60% extraction and make some tests on this and then add some further tests on a straight grade flour of at least 74% extraction. Our idea is to obtain both flours in one milling.

Open or Automatic Mill?

Aside from the problem of extraction, there are some other questions that may be asked about experimental milling. Is it better to use an open mill, such as the Allis Chalmers, or an automatic Buhler mill? If one is working with a wide range of wheats from soft to hard, and with varieties of different milling qualities, an open mill has some advantages. One can change the flow sheet, the setting of the rolls, and the clothing, to suit the particular type of wheat. And since one is usually concerned mainly with comparisons within a given class of wheat, a standard procedure can be developed for each class. The main objection to the open mill is that the results are so dependent on the skill and subjective judgment of the miller. Once again we are faced with the problems of cost, staff training, and vulnerability to resignations.

We have used two main methods with the Allis Chalmers mill. The first involves milling to a standard yield of 72%. This procedure makes less demand on the miller's judgment but can hardly be classed as wholly objective. One difficulty to it has already been mentioned: it converts all the differences between the wheats (save those that it does not examine at all) into differences in flour quality. Of course, this can be borne in mind in interpreting data, and the procedure is certainly useful for some purposes.

As a second method, we have milled "to yield" as judged by matching the feed flour against the feed flour produced by a standard procedure from a standard wheat. This method is very much dependent on the miller — on his powers of observation, on his ability to discriminate among minute differences in color;

in short, on his subjective judgment. Even in skilled hands there is an appreciable experimental error. And this error may be highly significant if one is milling in the critical range of extraction.

How about the Buhler mill? It can be clothed and adjusted to give a certain extraction from a standard wheat, say No. 1 Manitoba Northern of 65 lb. per bushel. One can then mill all other wheats, or at least all other hard wheats, without changing the mill. We are then inclined to believe that the yields reported should mean something, and they probably do. So we can blithely proceed to test the quality of the flour.

This is the common solution used in many laboratories. But surely the results and the interpretation must depend on what amount of flour one sets the mill to yield. If the extraction is set low, one is again testing flour representing the essential quality of the endosperm only, and the comparative figures for yield probably have less meaning. On the other hand, there is a limit to the yield that can be obtained with the short flow of the Buhler mill, though it is surprising how high a yield of good quality flour one can obtain by suitable adjusting and clothing.

Buhler Mill Problems

One thing that worries us about the Buhler mill is the wearing of the rolls and the resulting effects on the yield and quality of flour. You will recall that Mr. Eva and his group in Winnipeg (THIS JOURNAL, May 1957, p. 124) made a considerable study of this point. It is clear that it is difficult to obtain reasonably comparable results from Buhler mills in different laboratories. Even though the rolls may have been uniform when the mills were bought, the rolls in the different mills have worn to different extents and vitiate strict comparison. This point has received little attention because few laboratories have more than one Buhler mill; and if a laboratory does have two, they are normally clothed and adjusted for milling different types of wheat, say hard and soft.

How difficult is it to keep two Buhler mills in the same laboratory in line? We are expecting to find this out since we will need two or three Buhlers if we decide to switch from the Allis Chalmers to automatic milling. We are actually thinking of providing one extra mill to hold as a standard. That is to say, if we have two working mills, we shall have a third standard mill. We shall first adjust all three mills so that they give identical flours — or am I too optimistic and should merely say closely similar flours. The standard mill will then be used only about once every twelve, or possibly six months, for checking the performance of the working mills, and the need for regrinding or replacing the rolls. We have also been experimenting with the possibility of pushing up the yield on the Buhler mill as far as we can, while still maintaining a reasonable quality in the straight grade flour. The most promising development in this area involves a small experimental bran duster, designed and built in our laboratory. By using this, we can recover and add to our yield about 1.0 to 2.5% of good flour.

In short, we are studying the possibilities of producing two types of flour from a single Buhler milling and of distributing our flour tests between these two types. Perhaps this sounds very simple to you. Indeed, I suppose it is quite simple to decide to follow this procedure and to enumerate the types of tests that would be applied to each flour. But such a decision would be relatively arbitrary in my opinion. So we have an applied research which is striving to produce the facts — the facts of this case — the facts that will enable us to make a rational scientific decision (we hope) on what it is best to do.

In A Nutshell

This brief discussion of experimental milling is merely illustrative of a type of applied research. You will agree, I am sure, that it is aimed at a practical problem that faces many cereal chemists who are engaged in testing wheats rather than flours. We have other similar problems: name the area, however superficially simple it seems; examine it; and you will find unsolved problems on which cereal chemists have probably been working for years. They exist in test baking, in dough testing, in macaroni making, in malting, in brewing, and in every other area in which empirical testing is still used to assess the qualities of cereal grains and their products.

These are practical and pressing problems. In the long run their final solution will depend on progress made in fundamental research. But this is a slow process. In the meantime, tentative solutions must be sought more rapidly by applied research.

How does one operate a laboratory effectively?

With costs firmly in mind, and a judicious distribution of investment among routine studies, applied research, and fundamental research.

Sounds simple, if you say it fast. It may be simple, but it is not easy; in truth, it is difficult enough for a lifetime study.

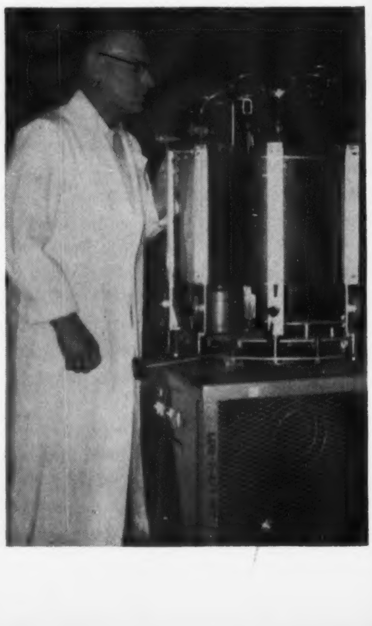
Quartermaster:

(Continued from page 174)

Policy and Projects

Although the Cereal and General Products Branch cannot give any consideration to the commercial uses of the products which it develops, it is noteworthy that many items initially brought out by this group have aroused intense interest among industrial producers. For instance, canned baked products based on Quartermaster formulations are now appearing on grocery-store shelves. Much interest in the instant bread mix project is also evident. Except in the case of military necessity, secrecy is not the rule, and the results of research are freely shared with industry.

The Wartburg apparatus aids research on yeast metabolism.



RECENT ADVANCES IN FEED TECHNOLOGY[1]

ROBERT C. WORNICK, Charles Pfizer & Co., Inc., Terre Haute, Indiana

THE PAST QUARTER-CENTURY has witnessed an agricultural revolution. The total farm population has dropped about 50%, but the country still remains well fed. Although the general population has increased about 35%, consumption of foods of animal origin has increased over 50%. This has led to a shift in the nature of agricultural output, and focused attention on ways of increasing production of meat, milk, and eggs.

The increased demand for animal products has been met in part by breeding for better production, by more efficient disease control, and through mechanization and specialization on the farm. Another major factor has been the significant improvements in nutritive qualities of manufactured feeds. This has resulted in faster growth and earlier marketing, as well as in more efficient use of feed by the animal.

The following discussion will cover a few of the major advances in feed technology which have been made during the past year or two. Since adequate coverage of so broad a field is obviously difficult, numerous references are provided as sources of further data on each subject. This paper will highlight research on potential feed additives, new findings on existing products, promising new applications for pelleting, developments in feed mixing, and the use of feeds and feed supplements in liquid form.

Research on Feed Additives

Tranquilizers. These compounds have attracted considerable attention since they were introduced into human medicine just a few years ago. Animal nutritionists and veterinarians soon became interested in their possible action on livestock and poultry. Two avenues of use were studied: 1) actual sedation of wild or nervous animals or birds, and 2) possible nutritional effects without sedation via the feed.

Potential applications included high-strung layers such as White Leghorn chickens, pheasants and other game birds raised in captivity, feeder calves coming into enclosed feedlots from open range, cattle being shipped to market and held prior to slaughter, nervous household pets, bulls and stallions, etc. Possible effects from low-level feeding in the second category were completely unknown.

One of the first products studied was ground whole root of the *Rauwolfia* genus. Products of this plant, chiefly *Rauwolfia vomitoria* and *Rauwolfia heterophylla*, were tested. Since the ground root preparations varied in activity, one of the alkaloid components, reserpine, was extracted and fed in pure form. The formula for the pure alkaloid, reserpine, is shown in Fig. 1.

Because of the cost and limited availability of pure reserpine, as well as the variation in activity inherent in ground root preparations, a search was initiated for an effective synthetic product. This program resulted in the selection of hydroxyzine. The formula for this compound is shown in Fig. 2.

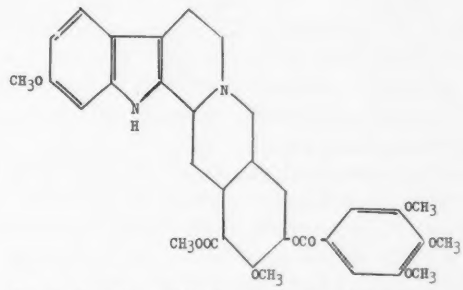


Fig. 1. Reserpine — Trimethoxybenzoyl methyl reserpate.

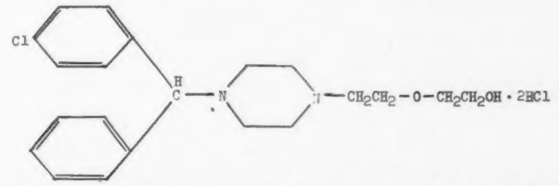


Fig. 2. Hydroxyzine — 1-(p-chlorobenzhydryl)4-(2-(2-hydroxyethoxy) ethyl)-diethylenediamine hydrochloride.

Initial studies were begun by feeding graded levels in the ration to chicks to measure growth effects. While the responses observed to date have not been outstanding, there was enough promise to warrant continuing with additional trials. The results with swine were comparable to those with poultry.

The most promising results to date have been obtained by feeding tranquilizers to ruminants at low levels. Minute amounts in the feed have elicited pronounced growth responses and improvements in feed conversion, without visible sedation effects on the animals. The responses are obtained over and above the stimulation afforded by added antibiotics and stilbestrol.

Tables I and II illustrate results obtained to date (41) in steers and lambs at the Pfizer Agricultural Research Center.

Another report (42) shows similar improvements in rate of gain and feed efficiency in both lambs and steers. No downgrading of carcasses or decreases in dressing percentages were observed in any trial, whereas several showed significant improvements.

[1] Presented before AACC Niagara Frontier Section, Buffalo, N.Y., Jan. 13, 1958.

TABLE I
EFFECT OF HYDROXYZINE ON WEIGHT GAINS AND FEED EFFICIENCY OF STEERS

HYDROXYZINE	AVERAGE DAILY GAIN	FEED PER POUND OF GAIN
mg/head/day	*lb*	*lb*
0.0	2.25	10.41
1.25	2.83	9.12
2.5	2.68	9.16
10.0	2.82	9.16
50.0	2.74	8.68
500.0	2.61	9.16

TABLE II
EFFECT OF HYDROXYZINE ON GROWTH AND FEED EFFICIENCY OF LAMBS

HYDROXYZINE	AVERAGE DAILY GAIN	FEED PER POUND OF GAIN
g/ton	*lb*	*lb*
0.0	0.477	7.35
0.24	0.473	7.54
1.2	0.577	6.98
6.0	0.498	7.19
30.0	0.485	7.31

A subsequent Iowa report (9) has confirmed growth response data on supplementation of lamb rations with hydroxyzine.

Another interesting use of tranquilizers stems from the results on pheasants by the Cornell workers (23). Reserpine at 7 mg. per kilo of diet markedly reduced conflict of males and females while on the treated feed. The results of another Cornell test (Table III) show reduced feather-picking in pheasants on feed containing 5 g. reserpine per ton.

TABLE III
EFFECT OF RESERPINE ON FEATHER-PICKING BY PHEASANTS

	FEATHER-PICKING			
	2 Weeks	4 Weeks	6 Weeks	Average
	%	%	%	%
New York feed control	46	62	74	60.7
Purina control	42	68	69	59.2
Purina plus reserpine	31	47	52	45.0

This is an interesting development, as feather-picking and cannibalism by game birds raised in captivity have been serious problems. In breeder hens, reserpine reduced ovulaton and lowered fertility and hatchability. Further studies are needed to explore the use of these products in game birds and in other wild or high-strung animals.

New Antibiotics. An important phase of Pfizer research is screening for new antibiotics, over 200 of which have been isolated to date. When a new antibiotic shows promise for clinical use, it is subjected also to detailed evaluation for possible uses in agriculture. Such a promising newcomer is oleandomycin, which has already established itself as a valuable adjunct in treatment of human disease. This antibiotic is a basic compound which dissolves readily in dilute acid solutions. Its approximate empirical formula is $C_{37}H_{67}NO_{13} \cdot HCl$. Its antibacterial activity is similar to that of pencillin in that it is effective mainly against gram-positive organisms (45).

In recent years, many investigators have observed somewhat lower growth responses and feed efficiency improvements due to the commonly used antibiotics. Similarly, animals and birds on control diets have appeared to make better gains. These phenomena are attributed to improvements in environment through generally decreased "subclinical disease levels," or to the reduction or elimination of pathogenic organisms. This new antibiotic, oleandomycin, in poultry feeds has provided a greater stimulus to gains. The results, shown in Table IV (Washington State College), illustrate this effect observed in several experiments.[2]

TABLE IV
STIMULATION OF POULT GROWTH BY OLEANDOMYCIN

ANTIBIOTIC		AVERAGE WEIGHTS, 5 WEEKS
	mg/kg	*g*
None	...	528
Procaine penicillin	4.4	535
Streptomycin sulfate	4.4	510
Terramycin	11.0	541
Oleandomycin phosphate	4.4	630

Table V shows a similar summary of feeding results (40), with chicks in batteries, from the Pfizer Agricultural Research Center.

TABLE V
STIMULATION OF CHICK GROWTH BY OLEANDOMYCIN (BATTERIES)

ANTIBIOTIC		2 WEEKS	4 WEEKS	FEED PER POUND OF GAIN
	g/ton			*lb*
None	0	161	364	1.98
Penicillin	4	159	358	2.01
Penicillin	400	177	379	1.97
Oleandomycin	4	175	400	1.96
Oleandomycin	40	174	380	1.96
Oleandomycin	400	169	374	1.97

Growth of chicks in floor pens and of baby pigs has been similarly enhanced.[3] Further studies are under way.

Unidentified Growth Factors. The increasing use of vegetable-source ingredients in rations of poultry and swine has been made feasible by supplementation with special sources of vitamins, minerals, and amino acids. Certain essential unidentified growth factors (UGF) have been supplied by including animal-source ingredients and products of marine origin in the ration. Because the supply of animal-source products has not kept pace with growth of livestock population, obtaining even the minimal quantities of such ingredients necessary to balance a ration in UGF is sometimes difficult. Moreover, these ingredients are relatively expensive. It has been found possible to supply adequate UGF through a fraction of 1% of a fermentation product which is a concentrated source of these factors, rebalancing the ration mainly with more vegetable-source ingredients. These modified rations are less expensive and nutritionally as adequate as those containing more ample percentages of animal-source ingredients.

Tables VI and VII (33) illustrate the replacement of

[2] McGinnis, J. Abstracts, 10th Washington State College Animal Industries Conference, Pullman, Wash., Nov. 15, 1957.
[3] Unpublished data, Chas. Pfizer & Co., Inc., Agricultural Research Dept., Terre Haute, Indiana.

conventional UGF sources with a standardized fermentation source of UGF in rations for chicks and poults.

TABLE VI
CHICK RESPONSE TO DIFFERENT SOURCES OF UGF AT CONSTANT CALORIE-PROTEIN RATIO

PROTEIN	CALORIES PER POUND	CALORIE-PROTEIN RATIO	4-WEEK WEIGHTS AND FEED EFFICIENCY (MALES): Control		3% Fish Meal		0.15% Fermentation Product[a]	
	%		g	lb	g	lb	g	lb
850	20	42.5	338	(1.81)	358	(1.82)	351	(1.83)
935	22	42.5	369	(1.62)	388	(1.57)	387	(1.59)
1020	24	42.5	369	(1.43)	384	(1.46)	381	(1.44)

[a] Vigofac, Chas. Pfizer & Co., Inc.

TABLE VII
TURKEY RESPONSE TO DIFFERENT SOURCES OF UGF

SUPPLEMENT	EIGHT WEEKS: Average Weight	EIGHT WEEKS: Feed Efficiency	EIGHTEEN WEEKS: Average Weight	EIGHTEEN WEEKS: Feed Efficiency
	lb	lb	lb	lb
None	3.97	2.26	13.8	3.61
0.45% Fermentation product				
10% Fish meal + 3% whey	4.24	2.13	14.3	3.48

Many feed manufacturers have now modified their formulas to include more vegetable-source ingredients and a concentrated fermentation source of UGF. The rebalancing which is necessary is chiefly to maintain levels of protein, energy, minerals, and vitamin B_{12}. The extent of reduction of over-all ration cost will depend on prices of the major ingredients — corn, soybean oil meal, and the UGF sources.

Ration changes such as the above have been carried out with numerous commercial broiler formulas. Depending on original composition, the cost reductions have ranged from a few cents to $8.00 per ton. These advantages would exist if, with the inclusion of the fermentation source of UGF, growth and feed conversion were no better than on the original rations. In many instances, the fermentation source, either alone or combined with other UGF sources, has in practice elicited greater growth and feed efficiency. This has added to savings already realized through lowered ration costs. Detailed discussions of the economics of UGF supplementation in various diets are available[4] (33).

Selenium. Although this element has been known for almost 150 years, it has come into prominence in the nutrition field only this year. Prior to this, selenium was regarded by the animal nutritionist and veterinarian as a contaminant in soil. A number of plants, such as wild aster, woody aster, milk vetch (*Astragalus*), white sage, and arrow grass, are able to absorb large amounts of selenium and thereby become toxic to animals if eaten (10).

Klaus Schwarz and associates at the National Institutes of Health have been studying for several years a "Factor III" which prevents liver necrosis in rats on a deficient diet. Their recent findings (39) indicated that inorganic sodium selenite at levels as low as 4 μg. per 100 g. of diet would prevent liver necrosis.

Comparable results have also been reported by the group at Cornell under M. L. Scott (38). Likewise, E. L. R. Stokstad and co-workers discovered by similar techniques that 30 μg. of selenium per 100 g. of diet can substitute in part for vitamin E in preventing exudative diathesis in chicks on a torula yeast diet (36). The selenium levels in natural feed ingredients are reported to vary between 0.03 and 0.8 p.p.m. (35).

Thus a trace element, previously known to be toxic at 5–10 p.p.m., is now shown to be actually beneficial at levels of a fraction of a part per million. It seems doubtful whether selenium supplementation of feed will be practical, in view of the wide variation in natural content of many ingredients. However, the recent discoveries of the roles of molybdenum, zinc, and copper in animal nutrition suggest the need of further study in this important, and often neglected, field of trace elements.

Amino Acids. As rations of the future become more complex and energy content increases, amino acid supplementation may well be required. Continued improvements in formulating poultry diets have now "broken the barrier" of 2.0 lb. feed per pound of gain. Many studies have been made on broiler diets supplemented with various amino acids. Although methionine is now in common use, the cost of other amino acids, such as lysine and tryptophan, is still too high to permit commercial use.

In the food industry, considerable interest has developed in supplementing wheat products with lysine. In feeds, the increasing popularity of milo and barley is focusing attention on amino acid balance, and on lysine in particular. Grain sorghum production in the U.S. has almost quadrupled since 1930. As a result, this grain is replacing corn at an attractive price in many areas for use in poultry and swine feeds (16).

Since milo is higher in protein than corn, it is generally substituted at a lower level in the ration. In low-protein diets, such as for swine, supplemental lysine may be indicated. A recent report described improved gains when 0.05–0.10% l-lysine was added to a 16% protein swine ration of the milo-soy-alfalfa type.[5] Diets based on sesame or cottonseed meals also benefited by addition of 0.1% lysine.

A similar report by the North Dakota group (17) concerns swine rations based on barley. In balancing, 85 lb. of corn require 15 lb. of high-protein supplement, but only 6 lb. of high-protein supplement are needed for each 94 lb. of barley. Unless extra care is taken in protein supplement formulation, it is difficult to supply adequate lysine.

Detailed studies have been reported on the lysine needs of growing and mature turkeys by the California workers. Results in one paper (30) indicated a varying requirement depending on age, with greatest need during the early growth phase. A second report (31) revealed

[4] Hare, J. H., W. M. Reynolds, W. K. Warden, and H. G. Luther; paper presented before Assoc. Southern Agricultural Workers, Atlanta, Ga., Feb. 6, 1956.

[5] Hillier, J. C. Proc. Oklahoma Formula Feed Conference, 1957, p. 31.

that only 60–75% of the lysine content of blood meal may be biologically available to poultry. These reductions are due to variations in processing methods and must be considered in poultry feed formulation to avoid deficiencies.

The future will inevitably see further activity in amino acid research as prices decline through improved manufacturing processes for these vital nutrients.

Vitamin C. Present use for ascorbic acid in manufactured feeds is restricted to specialty items for monkeys, guinea pigs, etc. These limited uses have not been without problems, however. Ascorbic acid is well known as a relatively unstable nutrient. Contact with moisture, air, minerals, and temperature all serve to accelerate decomposition.

When one considers that diets for monkeys and guinea pigs are manufactured mainly in pelleted form, the problems associated with potency retention become apparent. Indeed, it is not uncommon to experience more than 50% destruction of vitamin C solely as the result of the pelleting operation. The remaining potency falls off rapidly during subsequent storage at room temperature.

In Pfizer studies on the feed stability problem, some of the first materials evaluated were the "stabilized" vitamin C preparations. These products employ ethyl cellulose derivatives to form a partial protective film over the vitamin crystals.[6] Results in feeds have not been encouraging.

Research was then directed toward the preparation and evaluation of experimental ascorbyl compounds. A number of these have been tested in high-moisture feeds to date. Typical results are summarized in Table VIII. In this series, the supplemented feeds were stored in porous cloth bags in a circulating air cabinet maintained at 70% r.h. and 30°C.

TABLE VIII
STABILITY OF ASCORBYL COMPOUNDS IN FEED

Product	Potency Retention			
	2 Weeks	4 Weeks	6 Weeks	8 Weeks
	%	%	%	%
Ascorbic acid, USP	84	60	41	26
Compound 1	90	64	44	28
Compound 2	96	92	90	88
Compound 3	64	41	..	..

These data appear encouraging and work is continuing on this project. With stability assured, other uses may well be found for this important vitamin.

Enzyme Treatment of Feed Grains and Poultry Rations. A series of reports in 1957 from Washington State College by McGinnis and co-workers has been concerned with improvement of poultry feed quality by enzymes. Their early work indicated substantial increases in feeding value of certain types of barley from water treatment which activates natural enzymes (21, 27). Table IX summarizes several feeding trials with chicks which illustrate this.

[6] U. S. Patent No. 2,410,417.

TABLE IX
EFFECT OF WATER TREATMENT OF BARLEY ON CHICK GROWTH[a]

Grain	Water-Treated	Average Weight at 4 Weeks	Feed per Pound of Gain
		g	lb
Corn	No	366	1.93
Pearled barley	No	313	2.31
Pearled barley	Yes	404	1.75
Ordinary barley	No	289	2.17
Ordinary barley	Yes	387	1.87

[a] See reference 34.

Growth stimulation has been obtained from rations containing certain varieties of water-treated barley, pearled barley, oats, rye, and rice.

In a related direction, studies have been made of the addition of enzyme products to complete dry chick diets at levels of ½ to 2 g. per lb. Growth responses have been reported from such enzymes as Clarase, Taka-Diastase, and bacterial alpha-amylase. Both water treatment and enzyme addition continue under active investigation. An increasing number of grain varieties are being tested. If consistent advantages in growth promotion are disclosed, the results may find application in the barley-producing areas of the world.

Nutrition and Eggshell Strength. It is known that during the summer, eggshells tend to be weaker. In laying operations, and especially under the cage system, a decrease in eggshell strength can result in a substantial increase in cracked and broken eggs. This can mean a significant financial loss to the raiser.

At the Pfizer Agricultural Research Center, determinations have been made of the effect of Terramycin on eggshell strength using a novel device. The egg is placed in a fixed location on a baseboard. A calibrated ramp hinged to the baseboard is placed on the egg. A cart of fixed weight is drawn up the ramp by a motor-driven reel until the pressure causes the egg to break. The fall of the ramp breaks the current and stops the cart at this point. The distance traveled by the cart is proportional to eggshell strength (18).

In experiments to date, 160 eggs from each treatment group were tested for breaking strength. Typical results are summarized in Table X.

TABLE X
TERRAMYCIN AND EGGSHELL STRENGTH

Terramycin in Ration	Relative Breaking Strength (Cart Travel)
g/ton	in
0	15.31
50	17.13
100	21.06
100 (Intermittent)	18.23

Although the data are preliminary, it would appear that antibiotic feeding will result in improved shell strength. More research is needed to confirm this effect and to study the mode of action of the antibiotic in this regard. The fundamental information resulting from such studies will be of value in developing feeding procedures in the future.

Pelleting Research

Increasing Nutritive Value. The feeding of animal and poultry diets in pelleted form has been practiced for about 25 years. Approximately 35 million tons of prepared feed are being fed to poultry and livestock annually. Overall, about one-third of this total is pelleted and this fraction is increasing steadily (44). The relative amount of pelleted or crumbled poultry feed is even greater, some 70 to 80% being in this form.

The improved performance of poultry on pelleted feed has generally been believed to be due to the increased density of the pellets, permitting greater feed intake in less time. Other factors, such as increased palatability and nonseparation of ingredients, also have been cited (43). Recently, however, workers at Washington State College have observed significant growth increases over that with plain ground grain mash, when the pellets were reground to a mash and fed in this form (Table XI).

TABLE XI
WHOLE VS. GROUND PELLETS IN BROILER GROWTH[a]

FORM	WEIGHT AT 4 WEEKS	FEED PER POUND OF GAIN	DENSITY
	lb	*lb*	*g/ml*
Mash	377	1.86	0.67
Ground pellets	396	1.82	0.66
Whole pellets	397	1.91	0.64

[a] See reference 1.

To determine the cause of this response, individual ingredients were pelleted, ground, and then used to prepare the complete diet. The results indicated that feeds which contained reground corn pellets were superior to those containing regular unprocessed ground corn. The use of steamed, autoclaved, or water-treated corn did not enhance rate of growth (Table XII).

TABLE XII
REGULAR VS. PELLETED CORN IN BROILER GROWTH[a]

FORM OF CORN	WEIGHT AT 25 DAYS	FEED PER POUND OF GAIN
	g	*lb*
Regular, ground	266	2.08
Pellets	311	1.79
Reground pellets	336	1.73

[a] Jensen, L. S. Abstr., 8th Wash. State College Animal Industries Conference, Pullman, Wash., Dec. 6-7, 1956.

Considerable variation was encountered in the above effect when tests were made at other locations. Samples of corn from several areas were therefore tested in the same manner to study the effect of the corn source on chick response. Marked differences were observed, as might be expected (Table XIII).

Another possible variable is particle size of the corn. In other experiments (26) corn was routinely run through a hammermill with a 1/4-in. screen. Additional tests were therefore made to compare the regular grind with corn passed twice through a mill fitted with a 1/8-in. screen. The corn was pelleted and reground after milling in each case. The results obtained indicate no pelleting response

TABLE XIII
CORN SOURCE AND CHICK GROWTH RESPONSE[a]

CORN SOURCE	AVERAGE WEIGHT AT 4 WEEKS		RESPONSE
	Mash	Pellets	
	g	*g*	%
Washington — A	346	339	— 2.0
Iowa	341	343	+ 0.6
Midwest (WSC)	336	373	+11.0
Nebraska	325	370	+14.0
California	340	350	+ 3.0
Minnesota — A	336	352	+ 4.8
Minnesota — B	351	372	+ 6.0

[a] Jensen, L. S. Presented at 10th Calif. Animal Industries Conference, Fresno, Calif., Oct. 21-22, 1957.

from the more finely ground corn. This may be due to the heat and pressure generated by hammermilling which results in a "pelleting-type response" when very fine corn (without pelleting) is fed.

The reports above suggest that some chemical change may occur in pelleting. Corn seems to be the ingredient most benefited by this process. Physical changes alone cannot explain the consistent growth improvement observed with reground pellets. It would seem unlikely that energy or protein value of the ration is enhanced by pelleting. However, the digestibility may be increased.

Pelleting, and preliminary water treatment of ingredients such as barley, tend to elicit additive responses. Thus, the pelleting process does not exclude the use of enzyme additions or water-soaking. A possible explanation is that pelleting reduces or eliminates the amount of natural inhibitors present. Such inhibitors have been reported in alfalfa, cottonseed meal, raw soybeans, and linseed meal.

High-Fat Pellets. The addition of high levels of fat to mixed feeds began about 1953. Current annual consumption of animal fats in feeds today is estimated to total about 300 million lb. This comprises only 10–15% of total yearly animal fat production (46). Recent USDA estimates predict a steady volume of fat output for 1958. Decreasing use of fats in soaps has been more than offset by rising use in animal feeds, which would suggest little likelihood of price reductions in the near future (6, p. 1).

The level of fat to be added to a specific feed is governed by such factors as 1) purpose of addition (energy source, dust control, etc.); 2) energy level desired; 3) type of feed and absorptive capacity; 4) ability of equipment to mix and handle; and 5) cost compared to that of other ingredients.

In most practical diets, the fat level has been kept below 8%. At a recent Delmarva conference, a level of 5% was indicated as the economical upper limit (7, p. 6). It has been suggested (46) that excessive fat levels may not only be uneconomical, but may contribute in some way to a fatty liver syndrome in laying hens and to lowered activity of microflora in the ruminant. Both feed manufacturers and suppliers of fats are studying the various facets of this important development.

The manufacture of high-fat diets in pelleted form has presented a major production problem. Special formulation and processing are essential for successful results.

In general, it has been reported that not more than 3–4% fat should be added before pelleting to obtain hard pellets. This upper limit is subject to some variation depending on feed formulation, amount and type of binder, etc. The remaining fat to be added is best applied to the finished pellets. If the feed is to be crumbled, the fat may be applied to the crumbles.

A number of reported suggestions follow, compiled from several papers (6, p. 11; 22, 24), as possible aids in producing high-fat pellets. These include use of thicker dies, finely ground ingredients, and higher temperatures of pellets from the dies. Fats with lower melting points, higher fat temperatures during application, and reheating the finished pellets are said to improve fat absorption. Binders such as bentonite, synthetic calcium silicates, precooked ground corn, and fermentation products have been proposed to yield harder pellets.

The Washington State College group suggests that addition of fat after pelleting may be more desirable in the light of some recent data. They also have observed slightly lower growth responses as fat levels increased.

High-Roughage Rations. A few years ago, about the only ruminant feeds which were being pelleted in any volume were supplements. However, investigators at New Mexico A&M and elsewhere found that pelleted complete rations for lambs produced better gains and feed efficiency than concentrates plus roughage. Results now available from studies at nine experiment stations sustain the earlier conclusions. Ration content varied in these tests from 67% concentrate plus 33% roughage to 30% concentrate plus 70% roughage, with added molasses and mineral (20).

Successful commercial feeding of lambs with pelleted rations is now a reality at large-scale installations in California and Oregon. Labor costs are lower owing to easier self-feeding and bulk handling of pellets. Their higher density permits savings in storage, shipping, and handling. The use of pellets also eliminates selective feeding and reduces wastage and wind losses normally encountered with meals. One report estimates that feed waste is cut up to 30% by using pelleted complete rations for lambs, and that two men can now handle 60,000 lambs via self-feeders (3). At present the pelleting of complete ruminant rations high in fiber is not economical in all parts of the United States.

Hay pellets are now under study at Oregon State College. Preliminary tests indicate higher gains on less feed. The pelleted hay takes up only about one-half the volume of baled hay and one-fifth that of chopped hay. Promising results were also obtained with hay pellets in a Cornell study with beef calves (8, p. 91). The data indicated better retention of nutrients when hay was pelleted, rather than harvested and stored loose or in bales. These investigators predict future cattle rations consisting of hay pellets, hay cakes, or briquets with a complete ration built in.

Such pellets would be made in the field and loaded and unloaded automatically. Pressure of 4,000 lb. per sq. in. would produce a hay cake about 1½–2 in. long, having a density of 35–40 lb. per cu. ft. Field pelleting would help to standardize the quality and physical characteristics of forage for feeding. However, specially designed equipment will be required for this use (7, p. 69).

Other Developments. Pelleted grain rations for dairy cattle are now under study at Washington State College (8, p. 22). The tests are being made in an elevated walk-through "milking parlor." Dairymen are reportedly complaining that their high-producing animals don't have enough time to eat all the grain they need during the brief time they are in the parlor. An excess of pelleted grain is being provided to each animal for a period of 8 minutes. The results of these novel studies should provide some very interesting and useful data for dairymen.

A new automatic pellet mill is now reported to be available (5). The unit requires no steam to form the pellets, which may make it especially suitable for smaller operators. Electrical devices control its operation and shut it off when the feed hopper is empty.

With use of higher levels of fat and/or roughage in pellets, the problem of obtaining sufficient hardness becomes more complex. Feed manufacturers are turning to inorganic binders as a partial solution to this problem. Bentonite has found considerable use for this purpose at levels of 1 to 5%, although some feed manufacturers still are concerned over possible undesirable effects on nutrients.

Two reports in 1954 (14, 32) revealed that vitamin A deficiencies would develop in rats and chicks fed a diet containing 3% or more of bentonite. The vitamin A activity in the ration was rendered unavailable to the animal because it was adsorbed onto the bentonite. However, later studies with practical diets showed no deleterious effects. A more recent test on yearling steers (19) showed no effect from feeding 3% bentonite in a ration containing 25% alfalfa. The authors suggested that the alfalfa pigments saturated the bentonite in the digestive tract, thus providing more vitamin A activity in free form for the animal. Further data on low-alfalfa, low-fat diets are needed to confirm the innocuousness of bentonite for such use.

Newer inorganic binders are the synthetic calcium silicates (4). These products have high fat-absorbing capacity, such that about three parts of fat to one part of binder will yield a fairly dry powder. This suggests a means for adding fat to feed as a "binder premix." The silicates are more expensive than bentonites at present and are therefore generally used at levels of 0.5 to 1.0%.

Along with the increasing research on pelleting, new problems have arisen. These revolve around the stability of the various antibiotics, vitamins, and drugs added to today's complex feeds. The trend toward high fat and

roughage in pellets is to employ more steam, thicker dies, and higher pellet temperatures. Higher fat temperatures and reheating of pellets have also been proposed. Under these more severe processing conditions, the stabilities of nutrients and drugs in feed formulas will require checking. Possible effects of higher fat levels on growth responses with pellet feeding also will merit study. Increased temperatures and steaming may also have an adverse effect on the fat in such feeds.

The above four sections indicate the many facets of research on pelleting. With increasing emphasis being placed on nutritive effects, fat addition, high roughage, field pelleting, etc., it would seem probable that the over-all consumption of pelleted feeds may rise steadily in the future. New and improved machines will further accelerate this trend.

Feed Mixing Research

Handling of Microingredients. In the past decade there has been a remarkable increase in the number of microingredients added to manufactured feeds. In broiler diets alone the number of such additives has virtually quadrupled during this brief period. This trend has accentuated many existing problems which include mixing, stability, quality control, labeling, and contamination.

A detailed summary is available[7] on this subject covering such aspects as selection of active ingredients and diluents, equipment, statistical control, and use of tracers. Several other pertinent papers are also of interest (29, 47, 48).

In selecting a commercial source of a specific microingredient, one must consider carefully the question of particle size. At the usual low levels of supplementation employed, there are definite upper limits in particle size if one is to ensure optimum distribution in the finished feed. In a paper by Bloom and Livesey (12) a few simplifying assumptions have been made and graphs have been constructed which indicate optimum average particle sizes for levels of addition from 10 mg. to 10 lb. per ton. A tabulation of recommended particle sizes, taken from their three graphs, follows.

Level of Ingredient per Ton of Feed and Optimum Average Particle Size

	μ		μ
10 mg.	<5	0.5 lb.	270
100 mg.	22	2 lb.	440
1 g.	45	10 lb.	725
10 g.	100		
50 g.	170		

Commercially available products from different suppliers often vary widely in average particle size. At the same time, it is not economically possible to produce an ingredient having all particles identical. A normal distribution around the average size always exists. Similarly, in the finished feed, the average number of microingredient particles per g. will vary from the mean value depending on the extent of separation after mixing, and on mixing efficiency. An appropriate overfill, or use of a slightly smaller average particle size, is often indicated for these reasons.

It is sometimes thought that, as long as a plant premix or a purchased custom mix is sufficiently low in potency, the active ingredients in the feed will be distributed satisfactorily. The desirability of having sufficient bulk, or volume, is often mentioned without regard for particle size of active ingredients. The opposite extreme is the use of only finely powdered ingredients by some manufacturers. A standing specification of "minus 200 mesh" ($-75\,\mu$) is stated. It is apparent from the table above that even this fineness may not be sufficient at very low supplementation levels.

It is also well known that the more sensitive microingredients are unstable in finely milled form in the presence of moisture and minerals found in feed. In certain cases there is a definite correlation between stability and exposed surface area per unit weight. Hence, a balance exists between distribution requirements and sensitivity of ingredients which contra-indicates routine pulverizing. In comparing sources of any microingredient, one must be certain that its average particle size is optimum.

The term "stability" has been widely used and sometimes abused. Literally dozens of different tests for stability are in use, including such common laboratory types as accelerated, long-term, high-temperature, room-temperature, high-moisture, high-humidity, oxidation, high-mineral, steaming, compression, weathering, irradiation, shelf, aqueous, etc. Each of these will yield data for specific applications when properly interpreted. However, the ultimate criterion must always be performance in the plant in typical formulas under actual manufacturing conditions, followed by storage in the warehouse and by the user.

One cannot arbitrarily suggest useful test methods, and corresponding overfills to incorporate, since it is obvious that each formula in every company may well represent an individual case. Differences in composition and holding time of premixes and finished feeds, and variation in manufacturing methods and use conditions, are too numerous to mention. Therefore, reported data on "room temperature storage" or "pelleting stability" or "mineral stability" must be very critically examined as to the nature of all the variables involved before meaningful comparisons can be made among various commercial microingredients.

Animal Tests of Microingredients. Very few feed manufacturers are equipped physically or financially to compare in animals a given microingredient from various commercial sources. However, performance in the animal is the controlling factor in selecting these products for premixing. Physical properties, potency, stability, and particle size may be comparable in many, although one or two will stand out in animal tests. All available data from suppliers and from agricultural experiment station trials, plus the experience of other members of the feed industry, should be studied. Visits to the suppliers' re-

[7] Wornick, R. C. Presented at 7th Annual Midwest Feed Production School, Kansas City, Mo., Dec. 3-5, 1956

search farms to observe test facilities are also helpful in reaching decisions. The importance of this aspect of selecting microingredients cannot be underestimated.

From the diversity of carriers used in the trade, it would seem that almost any feed ingredient would be acceptable. Actually, many factors must be considered, including possible effects on microingredient stability, and whether the carrier is an ingredient common to the particular feed formula. If not, will enough be added to require including it on the label? In addition, such diluent properties as density, particle size and shape, equilibrium moisture, hygroscopicity, dustiness, palatability, flow, pH, trace metals content, and nutrient value must be looked into.

It is generally desirable that all ingredients used as diluents in a premix be common to the feed formula. This obviates the need for changing the ingredient lists on tags. It is usually possible to avoid going outside the formula for diluents; however, this does not mean that ordinary run-of-the-mill ingredients will be acceptable. Many manufacturers obtain selected lots of 44% soy meal with a reduced amount of coarse particles on a 30-mesh screen to minimize separation of microingredients. Others mill the regular ingredients to attain this objective. Many prefer 50% soy for its greater uniformity, but again will select lots for use in premixes. Most manufacturers are careful to match the microingredient densities to those of the diluents wherever possible. Local diluent supplies should be checked for exact bulk density, either loose or packed as desired, for more accurate data.

Table XIV covers average packed densities of a few common active ingredients. The values in the table will also vary depending on the particle size and purity of the microingredient supplement and on the nature of diluents present, if any.

TABLE XIV
AVERAGE PACKED DENSITIES OF INGREDIENTS

INGREDIENT	lb/cu ft	INGREDIENT	lb/cu ft
Vianol-BHT	42	Phenothiazine	36
Stilbestrol supplement	47	Mn SO_4	94
NF-180	46	Vigofac	35
Myvamix-E	43	Nicarbazin (25%)	31
Vitamin A — 250-P	47	Procaine penicillin	48
25% Choline chloride	28	dl-Calcium Pantothenate	47
dl-Methionine	27	TM-10	53

There are many theories as to optimum procedures as regards the order of adding ingredients. All agree on the necessity for adding a portion of the major diluent before the microingredients. However, some plants maintain the practice of adding at least half the diluent to the idle blender, followed by the microingredients, and then adding the remaining diluents. Others add only a few hundred pounds of diluent to a ribbon mixer, followed by the microingredients. The blender is then started and kept running while the remaining diluents are added. This procedure reportedly accomplishes some preliminary premixing during addition of the diluents, and yields uniform blends in less over-all time. Attention to order of addition can shorten mixing cycles.

A very interesting discussion of "Unmixing" by Burton (15) was published in 1956. There are many questions about "overmixing" and "unmixing," but few practical experiences have been reported. Difficulties can be expected in mixing, conveying, and packaging when particles of widely differing densities occur in the same mix. Attention to densities as discussed earlier can eliminate this problem.

With the emphasis on finer-sized active ingredients, many manufacturers express concern over dust losses during blending. Many reduce the vacuum on their dust collection systems during premixing to reduce losses of activity. Close attention is being paid to prompt emptying of cyclone collectors and assaying the contents to determine possible losses. Excessive concentrations of drugs in dusty air around blenders and conveyors may present a possible personnel hazard, and also increase insurance rates. These difficulties are being effectively reduced in many mills by addition of liquid fat to the premix during blending. Levels of 1 to $2\frac{1}{2}$% have been successfully added to many premixes in both ribbon, vertical, and muller-type mixers. In addition to dust reduction, the fat minimizes separation of ingredients. This permits the inclusion of some troublesome microingredients that might ordinarily have to be omitted because of their separation tendencies in dry blends. A similar approach involves the use of expeller soy meal, etc., as a diluent.

Evaluation of Mixing Equipment. In selecting mixers, all economic comparisons obviously should be made on the basis of working capacity of the mixers being evaluated. This will vary between types, but may be considered to be about 90% of gross capacity. Capacities expressed in tons may be very misleading, since bulk densities of different feed mixes may vary widely. Other factors entering mixer selection are 1) number of components in the premix blend; 2) degree of uniformity required; 3) method of charging; 4) floor space and headroom available; 5) first cost, including purchase, installation, and modifications; 6) operating costs plus maintenance estimates and depreciation; 7) overall mixing costs per ton of blend; and 8) level of liquids to be added, if any. The objective is to obtain a thorough mix plus quick, complete emptying at the lowest cost and in the shortest time.

The sampling procedure is extremely important, and a different approach is used in almost every mill. A major consideration is sample size, which varies over a wide range from only a few grams up to several pounds. Some mills favor small samples, since it is felt that uniformity of essential ingredients is mandatory in a premix if optimum distribution in the feed is to be attained. This was particularly stressed on premixes for poultry starting rations. Other companies indicated that less stringent uniformity requirements were necessary in premixes, as they would receive a second mixing in the final feed blending operation anyway. It is impossible to generalize

on this subject, as every premix in every mill may well represent an individual case. However, a number of factors must be considered in arriving at a meaningful decision on sample size. These include (a) level of addition of premix to finished feed; (b) intended use of feed (e.g., for baby chicks?); (c) batch size; (d) sample size required for testing; (e) potency of individual active ingredients incorporated; and (f) particle size of active ingredients and carriers.

Most companies withdraw one or more pounds at predetermined times or points in the process, which are composited. The laboratory carefully blends the composite and withdraws a few grams for analyses as required. A few companies emphatically disapprove of any composite samples because they believe such handling will obscure inhomogeneities which may exist. Both approaches are valid in specific cases, and a study of the various factors discussed above under sample size must be considered in determining the best course of action. A logical solution to this problem would be to study the results of a series of single vs. composited samples via control charts. This would permit selecting that method which yielded satisfactory process or product control at lowest cost.

Another point of disagreement noted is on the correct point in the process or batch for sampling. Some companies probe the premix batch in the mixer, while others catch samples during the discharge of the blender. Many prefer to sample the premix from the drums, bags, or "tote bins" in which it is stored before use. In continuous line operations, the premix is sometimes sampled at the gravimetric feeder. Again, the proper choice of sampling location requires careful study. Since some mixing may occur during blender discharge, sampling from the drum or bin may show uniformity which did not exist in the blender, owing to incomplete blending or separation of ingredients. Conversely, separation of ingredients can occur during discharge, even though the batch was uniform in the blender. If the finished batch is mechanically conveyed, samples should perhaps be taken from the conveyor or from the final premix storage bin, or both.

Some consideration should also be given to the use of standard approved sampling devices such as slotted probes. An additional question is the number of assays to be performed per sample. It is surprising how many laboratories perform duplicate or triplicate determinations on single samples as a matter of routine. It can be shown mathematically that it is usually most efficient to perform single assays and increase the number of samples. This is certainly true when sample-to-sample variation is equal to or greater than the variation between replicate assays. In microbiological assays, the day-to-day variation is usually greater on a given sample than the variation between replicates on any day. Hence, a single test on four successive days is generally better than duplicates on only two or three days. With chemical assays of usual precision, more useful data are often obtainable from single assays on three or four samples than from replicates on only one or two.

A number of applications have been found for colored tracers. These include comparing the efficiency of different types and models of blenders using the same premix and blending time; determining optimum blending time in any given unit; and checking uniformity of distribution of other premix components. Different types of colors of tracers in successive batches of a given type provide a means of following turnover rates in other plants, or by dealers using the premix. Very high visible levels of colored tracers added to finished feed via the premix help convince the raiser that all essential nutrients were added.

To provide meaningful results, a tracer should exhibit physical properties and blending characteristics which are similar to those of the other microingredients. A good match in particle size, density, particle shape, and surface texture is very desirable. On the other hand a very friable material, or one which is hygroscopic or otherwise unstable, may yield misleading results. If chemical tests are necessary, the tracer should be a substance unique to the formula. The major types of tracers in use today fall mainly into four categories. These are colored material, compounds determined by chemical tests, fluorescent substances, and radioactive products.

A report from England (25) provides some thought-provoking material on the use of radioactive products to study feed mixing. A standard procedure for evaluating dry solids mixers is now being drawn up by a committee of the American Institute of Chemical Engineers. Some very useful data should be developed through the efforts of this group.

Liquid Feed Supplements

Liquid Feeding of Poultry. It has been standard practice for years to administer medications and sanitizers as solutions via the drinking water. A number of liquid proportioning devices are available for this use. Only recently, however, has research turned to the development of nutrient preparations for poultry which can be supplied through the drinking water. Potential products could be true solutions, emulsions, or possibly very fine suspensions. Dry powders which could be easily dissolved or otherwise reconstituted could also be used.

Few if any data are published on this subject, although studies are in progress in several parts of the country (2). Problems of stability are a major obstacle, both in the liquid product and after addition to the water. Such products should supply a significant quantity of amino acids or protein, energy sources, vitamins, minerals, etc. Such multiple products may prove unfeasible. However, the entire subject is one which merits consideration.

Liquid Feeding of Ruminants. Although molasses has been fed to cattle for years by individual farmers, only relatively recently the feed industry developed interest in adding other nutrients to this product. The most common liquid feed for cattle today consists of molasses with added urea, alcohol, and phosphoric acid, which may be fed free-choice or on a limited basis with grain or as a

partial replacement for grain (28). If the molasses is ammoniated, urea is not included.

A number of studies have been made at agricultural experiment stations. A few recent reports can be cited from Texas (11), Kansas (37), and Iowa (9), which show promising increases in gains and feed conversion from liquid supplements. Interest in adding antibiotics, vitamins A and D, and minerals to such products has arisen. Studies are under way in this field. Liquid products for cattle appear to have an established place in feeding programs as long as molasses prices remain normal.

Adding Microingredients as Liquids. As feeds become more complex, the number of microingredients is certain to increase. This will further complicate the already difficult process of producing a uniformly mixed feed. Careful formulation of feed supplements and careful premixing will go a long way toward minimizing difficulties. However, the addition of one or more supplements in liquid form could well become a routine procedure.

Several feed manufacturers already are applying some microingredients as solutions: these include vitamins A and D, cobalt salts, choline chloride, and certain drugs. A variety of positive-displacement, piston- and diaphragm-type feeder units are available and in use. The advantages of such a procedure include, among others, eliminating separation, more uniform blends, and in many cases eliminating dry premixing.

Applicable products may be true solutions, emulsions, or suspensions in water or oily vehicles. Soluble or suspendable powders are also of possible utility. Much data are yet to be developed on compatibilities in multicomponent preparations. Stability after spraying and blending into the feed must also be carefully studied. Studies are in progress along these lines and the outcome may well be the production of more uniform feeds through the use of liquid supplements.

Conclusions

The preceding discussion has attempted to highlight a few of the significant recent new trends of investigation in feed technology, including nutritional aspects. Some of these are of established utility, whereas others will require further study before possible commercial applications can be appraised.

In a recent summary on nutrition research (13), G. M. Briggs offered the following thought-provoking estimate: only 30 to 50% of major nutritional findings of value to the feed industry and 10 to 20% of basic knowledge of animal nutrition have been uncovered to date. This estimate, together with his appraisal of future findings in nutrition research, is recommended reading for those interested in a preview of things to come in this dynamic field.

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NUTRITION NEWS FROM Pfizer

Quality Ingredients
For the Food Industry
For Over a Century

TECHNOLOGISTS SEE NEED FOR FORTIFICATION OF FOODS SUCH AS BREAD AND PROCESSED CEREALS WITH VITAMIN B_6

While a "minimum daily requirement" has not yet been established for Vitamin B_6, the most recent data suggest the human need for this nutrient may be even greater than for thiamine and riboflavin. A composite of recent studies indicates that as much as 2-7 mg. of B_6 may be desirable in the daily diet.

Although Vitamin B_6 is widely distributed in foods, a large portion appears to be lost or destroyed during processing or cooking. One study contrasting the B_6 content of wheat fractions shows that while whole wheat flour contains approximately 2.09 mg./lb. of B_6, patent flour contains only 0.99 mg./lb.—a loss of 50% B_6 content through processing. Almost all white breads on the market today contain only 0.45 mg. of B_6 *per one pound loaf*. When you add to this the fact that meat in cooking has been found to lose as much as 57% of its B_6 content and that canning and processing of foods markedly reduces their natural B_6 content, you can see evidence of a marginal B_6 intake in the diet today.

There would appear to be good reason for food processors to consider fortifying their products with Vitamin B_6.

If you would like further information on this subject, write Pfizer for a copy of Technical Bulletin 96 and "*VITAMIN B_6—The Case for Dietary Enrichment.*"

* * *

New Facts About Lysine Supplemented Bread

The quality and efficiency of wheat protein can be markedly improved by supplementation with the essential amino acid, L-Lysine. (Pfizer produces L-Lysine by a unique fermentation process assuring highest quality.)

A recent nutritional report compared the protein quality and quantity of white bread, protein bread and egg. It shows that nine slices of ordinary white bread are required to equal one egg in terms of quality and quantity of protein. If white bread is supplemented with lysine, only five slices equal one egg.

The report shows that protein breads can be improved in a similar manner. If protein bread is supplemented with lysine, three and one half slices instead of five provide the same protein quantity and quality as one egg.

If you would like further information on lysine supplementation of bread and other products such as breakfast cereals, write to Pfizer for Technical Bulletin 89, "*L-Lysine Monohydrochloride.*"

* * *

New BI-CAP® Enrichment Concentrate For Cornmeal

PFIZER BI-CAP® was one of the first enrichment concentrates. And this "head start" in vitamins has continued. It means that Pfizer can help you with the newest developments in enrichment products.

PFIZER BI-CAP has recently been improved through vitamin research. It is now a lighter colored enrichment mixture with an even riboflavin dispersion that overcomes unsightly agglomeration.

A new addition to the BI-CAP enrichment line is BI-CAP Bolted Cornmeal Enrichment. Pfizer also continues to offer its BI-CAP Degerminated Cornmeal Enrichment plus both single and double strength flour enrichment mixtures. If you would like further information write **CHAS. PFIZER & CO., INC., Chemical Sales Division, 630 Flushing Avenue, Brooklyn 6, New York. Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.; Dallas, Texas**

OPPORTUNITIES ARISING FROM

The AACC's Role in The Cereal Industry

By Clinton L. Brooke, President, AACC; Merck & Co., Inc., Rahway, N. J.

FOR THE PAST forty-four years, the American Association of Cereal Chemists has served the cereal industry. It was founded by eleven chemists working in the flour mills of Kansas and Oklahoma, and has grown to over 1200 chemists working in flour mills, grain elevators, bakeries, prepared mix plants, corn processing plants, and academic and government laboratories.

Unlike the early days when the mill chemist and his work on ash, moisture, protein, and the baking test dominated the interest of the group, today's member can be interested in anything from fertilizer to textile sizing. This broadening of interest on the part of AACC members parallels the broadening scope of the cereal industry. The development of bleaching and maturing agents, the implementation of the enrichment program, the establishment of the prepared mix industry, and development of sensational new milling and baking processes are *all* the product of cereal chemists working in many diverse fields. It is because of this diversity that the AACC is the largest single group of cereal chemists in the world and represents a true international scientific society. *Membership in the Association is maintained by individuals in 26 foreign countries; subscribers to Association publications live in 68 foreign countries.*

The Association's Purposes

The purposes of the Association are these: 1) the encouragement of scientific and technical research on cereal grains and their products; 2) the study of development and standardization of analytical methods used in cereal chemistry; 3) the promotion of the spirit of scientific cooperation among all workers in the field of cereal chemistry; 4) the maintenance of high professional standards of its membership; and 5) the encouragement of a general recognition of the value of the chemist and biologist to the cereal industries.

Research Aims and Areas

The chemistry of wheat and its products is complex, as is true with most biological materials. The wheat berry contains carbohydrates, proteins, lipids, vitamins, minerals, etc. These are complex substances in themselves, but when combined in a living plant they present a real challenge to the chemist.

Today's age of specialization results in wheat research being broken down into a number of different areas. One chemist may specialize in proteins, another in fats, and another in vitamins; but annually they all get together to compare notes and try to fit the pieces of the puzzle together. These get-togethers occur at scientific meetings where the scientist can listen to reports of the work of others and mentally fit his work into place. Of course, the most important function of these meetings is the opportunity they provide for personal contact and exchange of experiences and ideas with workers in related fields.

Annual Meetings: A Common Forum

So far we've been talking about research. How about quality control and related production problems that involve the laboratory? What better place could you have to iron out problems with those who use and test your products than at an annual meeting? If a mill is having trouble

AACC MEMBERS

CATEGORY	PERCENTAGE
I. Manufacturers or processors	
A. Flour	20.4
B. Feed	10.6
C. Prepared mixes	12.3
D. Refrigerated and frozen baked goods	4.1
E. Bakery	7.4
F. Breakfast foods	5.4
G. Fermentation	4.6
H. Corn milling	4.0
II. Suppliers of ingredients and services	14.3
III. Independent laboratories, consultants, and government laboratories	10.0
IV. Members of university and college faculties	3.0
V. Suppliers of production and laboratory equipment	1.0
VI. Miscellaneous	2.9
	100.0

keeping a bakery client happy, here is an opportunity for the mill chemist to sit down and talk about the problems with the bakery chemist. Chances are, since they are in the same scientific organization, they have worked together on technical committees and have been friends for years. This is a distinct advantage to both user and producer, since solutions to the problems can be worked out on a sound scientific basis advantageous to both parties.

This common forum that the AACC provides for both buyer and seller is quite evident from the composition of our membership. The results of a recent membership survey, completed last fall, are shown in the box. It is obvious that the mill chemist still represents the largest single group in the AACC, but this group comprises only 20% of the total membership. And as with most of our membership, mill chemists represent buyers as well as sellers. It is this mingling of buyer and seller that makes the AACC a vital organization in the cereal industry.

Benefits and Problems in Meetings

Another point we've overlooked so far is the opportunity for industrial chemists (from mills, bakeries, etc.) to have contact with government and academic workers. About 13% of our membership is in this latter category. The industrial people can 1) learn what work is going on in fundamental research that might be applied to their own problems; and 2) they can settle problems through a better understanding with government representatives regarding grain grading, sanitation, etc.

Along with the benefits of diversity that the AACC and its members enjoy are some problems. The first of these problems is to design a technical program which provides some real "meat" for all segments of the group; something they can take back to management and say, "This is information we can use in our own laboratory." To accomplish this, the Association's program usually consists of some 50 to 70 papers, all of a technical nature. Scheduling 65 to 70 papers in four days (really three and a half days, allowing for the President's address and talks by prominent guest speakers) is a difficult task. Even with papers running no more than 15 to 20 minutes in length, it means a full day for each attendant. The average day at AACC meetings starts at 9:00 a.m. and adjourns at 5:00 p.m. with an average of 15 to 16 papers being presented. When the number of technical papers passes the 50 mark, it is necessary to schedule concurrent sessions. These sessions must be so arranged that interest conflicts are at a minimum. You may schedule a baking technology and feed technology session at the same time, but you would be unwise to schedule a feed technology and nutrition session simultaneously. The AACC tries to avoid concurrent sessions, but with a large number of technical papers such sessions become necessary if the length of the meeting is to be held to four days.

An important thing to remember about the AACC's meetings is the fact that the chief emphasis is on the quality of the technical program, and consistently large attendance at the technical sessions bears this out.

The second problem that diversity brings to the AACC is choice of meeting sites. Originally when the group was composed largely of mill chemists, the meetings were kept in the milling areas of the United States such as Kansas City, St. Louis, Chicago, and Minneapolis. In fact, in the past 44 years we have met 30 times in only six cities; we have met 26 times in the four cities named above. In recent years, the policy of the AACC has been to rotate meeting sites so that all segments of the membership have the opportunity of attending the annual meeting at little or no travel expense to their company. This provides opportunities for the younger members of the industry to participate in a scientific meeting and gain from the ensuing professional contacts. This is as much a gain to the employer as to the employee.

Technical Committee Work and Publications

The two most important functions of any scientific society are its technical committee work and its publication program. There are few important scientific societies in the world that are not active in one or both of these areas. At the present moment, the AACC has 16 technical committees at work on problems ranging from flour specifications to sanitation. Over 125 members are engaged in this activity.

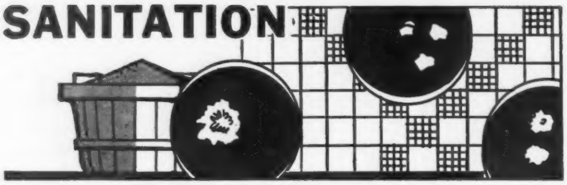
Our publications are known throughout the world's cereal industry as the prime source of information on cereal research and applied laboratory problems. CEREAL CHEMISTRY, a bimonthly research journal, is read by cereal chemists from Africa to the Soviet Union. It was established in 1924 as a continuation of the original AACC journal, begun in 1915 when the Society was founded. The journal you are reading now, CEREAL SCIENCE TODAY, was established in 1956 to fill the void between the many excellent trade publications in the field covering the production angle and the pure research journal.

As no chemist can work effectively without standard analytical methods, the AACC early in its history published a book of methods to be used in cereal laboratories. It has been revised six times since 1922, and the current edition, published in 1957, contains over 500 pages with some 300 different analytical methods applicable to cereal grains and their products.

Along with books on laboratory methods, the AACC has started a series of monographs on various phases of cereal technology. The first, published in 1947, covered the general subject of enzymes. The second, released in 1954, dealt with the vital problem of grain storage. So important was this second volume to cereal chemists throughout the world that the Russians took the trouble to have it translated and published in their own country. The AACC is now working on a third monograph which will embrace all the available knowledge on the chemistry of wheat and related products. *These publishing ventures are conducted on as close to a break-even basis as possible, and they provide an indispensable service to the cereal industry that only a professional scientific society can perform.*

The aim of the AACC now, as always, is to enable its members to learn more about the cereal grains and how to process them by attacking basic problems of the industry as a cooperative group. This cooperative effort has benefited, and will continue to benefit, the entire cereal industry and the public it serves.

SANITATION



SANITATION TRAINING SCHOOLS

In cooperation with the U. S. Food and Drug Administration, the AACC will hold a series of training schools for determining contamination in cereal grains and their products, through X-ray techniques and the identification of insect fragments and rodent hairs. (A brief announcement was made in THIS JOURNAL, July 1958.) There will be three schools: in San Francisco September 15–19, 1958; in New York City mid-February, 1959; and in Chicago in mid-April, 1959. They will train personnel in the cereal industry in the latest sanitation methods. The schools are the direct result of the work of the Sanitation Methods Committee of the AACC.

These training schools will be in the form of lecture-laboratory workshops, in which the lectures will accompany or precede the laboratory work. Interspersed in the laboratory studies will be lectures and the use of mimeographed laboratory aids. Each registrant must bring his own wide-field microscope and lamp. A nominal registration fee of $6.50 will cover the cost of supplies. Instructors will be furnished by the U.S. Food and Drug Administration.

The program is geared to the general level of experience of the registrants, and arranged in such a way that quite possibly the qualifications of all registrants will fall within its scope. Any individual who wishes to enter but doubts his qualifications is urged to register and then bring up the matter through correspondence with Mr. Kenton L. Harris, whose address is: U.S. Food and Drug Administration, Washington, D.C.

The following brief outline gives an idea of the contents of the course:

MONDAY, 9:00–5:00

(1) Setting up of equipment.
(2) Brief review of the week's work; introduction.
(3) Purpose and goals of the course.
(4) Individual orientation in fragment counting. A series of selected, prepared material with slides and filter papers for each participant, and the use of specially prepared forms to permit ready reference during discussions. This orientation session will be designed to (a) determine the diversification of the group, and (b) permit each participant to recognize his level of fragment analysis, based on over-all numerical reports and the technical discussion following each series.

TUESDAY, WEDNESDAY, THURSDAY, 9:00–5:00

Recognition and identification of insect fragments, based on insect morphology. Lecture-laboratory approach in which all participants will be provided with mimeographed guides that will coincide with the major categories of the lecture, visual aids, and microscope work that is "simultaneously" discussed in the lectures:

(1) Fundamental, practical morphology of common insect species (adults and larvae) infesting cereal grains and grain products.
(2) Dissection and isolation of common "structural fragments."
(3) Recognition landmarks for "structural" and "nondescript" fragments. Attempt to standardize fragment counting in these two categories.
(4) Identification (species and/or common group) of fragments — a systematic-comparative approach.

FRIDAY, 9:00–12:00 noon.

(1) Analysis of prepared plates with special reporting forms which will draw upon the previous 3-day session.
(3) Discussion and summary.

FRIDAY, 1:00–5:00

Lecture-laboratory on basic hair structure and fundamentals of rodent-hair identification.

SATURDAY, 9:00–12:00 (optional)

(1) Brief review of the X-ray technique for detection of internal infestation.
(2) Radiographic reading; interpretation of radiographic shadows; specially prepared radiographs provided for each participant.

the President's Corner

news of the association

1959 AACC ANNUAL MEETING

Plans are shaping up well for the next AACC annual meeting, to be held in Washington, D. C., May 3–7, 1959. Subchairmen already appointed and the subjects under which they will arrange their part of the program are: W. H. Schoenherr, grain sanitation; D. K. Dubois, baking and bakery products; James M. Doty, practical aspects of grain and/or cereal testing; Majel M. MacMasters, grain structure and grain constituents.

Sessions in the following technical areas also are being lined up: cereals in feeds; cereals in foods; grain drying; milling technology; technical committees; food additives; microbiology; problems in the wet-milling industry.

The program chairman, Frank E. Horan, will welcome offers of papers under these headings, but urges that they be submitted promptly. Also, if anyone would like to see other technical areas included, the committee will be happy to receive requests or suggestions. Address the chairman at Hercules Research Center, Wilmington, Delaware.

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Approximate Analysis: Gerald D. Miller, *Chairman*
Drugs and Antibiotics: R. C. Wornick, *Chairman*
Vitamin Analysis: E. F. Budde, *Chairman*

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National Check Sample Service

L. H. Fischer, *Chairman;* H. C. Becker, J. M. Doty, D. K. Dubois, F. R. Earle, J. B. Morgenson

Prepared Baking Mixes Analysis

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Rate of Hydration of Powdered Milk: C. K. Sherck, *Chairman;* J. S. Barry, D. E. Downs, L. F. Jents, Charles O'Malley, C. F. Obenauf, J. W. Tucker
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L. D. Longshore, *Chairman;* D. C. Abbott, E. C. Edelmann, Jacob Freilich, D. F. Meisner, Wendell Reeder, Henry Solle, F. W. Wichser, S. N. Vilm, W. H. Ziemke

Sanitation Methods

Kenton L. Harris, *Chairman;* Harvie Barnard, Ross Cory, D. K. Dubois, W. O. Edmonds, Harold Goossens, Robert Kilborn, T. H. McCormack

Sedimentation Test

W. T. Greenway, *Chairman;* D. C. Abbott, F. B. Agasie, M. E. Armour, H. C. Becker, D. K. Dubois, W. J. Eva, J. W. Giertz, W. L. Heald, A. J. King, J. L. Lamkin, G. W. Lenser, Edward Liebe, L. F. Marnett, C. D. Neill, Paul D. Ocha, L. E. Schonlau, H. H. Schopmeyer, Elden Smurr, Tod J. Stewart, Martin Wise, Mary V. Zaehringer

Soybean Analysis

L. R. Brown, *Chairman;* E. F. Budde, M. W. Dippold, Kenneth Holt, J. E. Lawler, C. K. Sherck, G. H. Rapaport, M. L. Valetta

Vitamin and Mineral Analysis

Welker Bechtel, *Chairman;* E. F. Budde, R. E. Brown, Jerry Chawes, D. B. Davis, C. B. Gustafson, J. J. Kagan, G. J. Hill, J. F. Mahoney, E. F. O'Neill, J. H. Panton

A.A.C.C.

LOCAL SECTIONS

Niagara Frontier Section's September meeting will include a visit to the plant and laboratory of the Birdseye Frozen Food Division of General Foods, Inc., at Albion, N. Y.

Hearty thanks were tendered to Ann Collins and her family for their hospitality at this year's picnic on June 28, enjoyed to the full by about 50 people, including some 20 youngsters. There is no doubt as to members' desire to have another such picnic next summer.

New members of the section are David Dubois of Beech Nut Lifesavers, Rochester, and Ronnie Light of Standard Milling Co., Buffalo.

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Pacific Northwest Section welcomed AACC President Clinton L. Brooke as a guest at their highly successful two-day annual meeting June 23 and 24 in Spokane. President Brooke spoke informally to the members at luncheon on the first day, and took part in the program with a talk, "The cereal chemist, yesterday, today, and tomorrow." Other papers given were: "Improvement in the nutritional value of barley" – James McGinnis; "A survey of ash determination" – Dick Fuhr; "A sedimentation method for the determination of the particle size of flour" – Victor Evans; "Enzymes in dough fermentation" – Standard Brands Inc.; "Some effects of nitrogen fertilizer treatment on wheat protein" – Doyle C. Udy; "Genetics as applied to wheat breeding" – W. K. Pope; "Effect of water-solubles of wheat flour on cookie diameter" – W. F. Sollars; "Effect of some lipids and lipid derivatives on cookie spread" – E. W. Cole; "Report on the Montana Grain Growers Association" – Donald Pitts; and "Report on the activities of the Pacific Northwest Crop Improvement Association" – W. H. Mann.

New officers are Lynn Speaker, chairman; Doyle Udy, vice-chairman; Joe Shogan, secretary-treasurer. Next year's annual meeting will be held in Seattle.

Accuracy awards were announced recently. Based on three tests run on check samples, awards for overall accuracy were: first and winner certificate, Waldon Chambers; second, H. R. Fisher; third, J. W. Woodahl. In the individual tests, George Moran showed the best accuracy on the protein test. Mr. Chambers excelled in the ash test, and moisture test honors went to Zola McFarland.

People, Products, Patter

• • • People

James O. Alexander joins Reynolds Metals Co. as assistant manager to handle marketing of Reynolds aluminum foil packaging to the baking and milling industries; headquarters in Richmond, Va.

John A. Brislin joins Takamine laboratory, Division of Miles Labs, Clifton, N. J., as technical sales representative in Northeast and part of Canada; from Merck & Co.

J. M. Cotton named by Schlumberger Well Surveying Corp. to direct training program for sales engineers and service personnel, to handle their Nuclear Magnetic Resonance (NMR) Analyzer; has been vp and European manager for Electro-Tech International, Houston.

Robert H. Cotton joins Continental Baking as director of research, Rye, N.Y.

Marianne M. Kalocsky becomes junior technologist at General Foods Corp.

John H. Kelly named sales promotion manager of Vitamin Division of Hoffmann-LaRoche, Inc.; **R. Semmes Clarke** named manager of sales control.

Robert D. Knoebel promoted to field sales manager for eastern region of chemical sales division, Chas. Pfizer & Co.; **Carl Lorentzen** appointed to the division's industrial department.

Charles E. Neal becomes senior chemist with food research group at Pillsbury Mills, Minneapolis; from Campbell Soup.

Robert A. Olsen joins products research department of Procter & Gamble's food products division.

Bernhard Pagenstedt becomes chief of the research laboratory of the Grands Moulin de Dakar (French West Africa); formerly with Brabender, Duisburg, West Germany.

Sheldon S. Rennert, research biochemist at Takamine Laboratory, Clifton, N. J., starts on a postdoctoral research fellowship at University of Tokyo, Japan; will study techniques for isolation and crystallization of enzymes.

Leonard T. Saletan of Wallerstein Laboratories, New York, appointed chairman of technical committee, American Society of Brewing Chemists.

William J. Smith retires as salesman for Vitamin Division, Hoffmann-LaRoche, Inc., in New York metropolitan area and New England, for the past 12 years.

Clyde J. Steele promoted from Gaines Research Laboratory, Post Division of General Foods, to quality engineer of Post Division. He is newly elected chairman of AACC's Cincinnati Section.

Russell J. Stenberg joins staff of oilseed crops laboratory, USDA Northern Utilization Research and Development Division, Peoria, Ill.

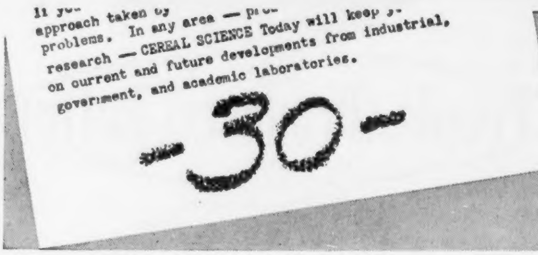
John A. Succo joins Food Division of Procter & Gamble.

William H. Tonkin retired August 1 after 35 years with Standard Brands Inc. Had been technical director of the Frozen Products Division at Kansas City, Mo.

Clarence K. Weisman, general manager of quality control and food research, Armour & Co., elected president of Research and Development Associates Food & Container Institute for the coming year. **William B. Bradley** of American Institute of Baking named chairman of the board; **C. G. Harrel** of Pillsbury Mills, vice chairman; **Weld Conley,** Chain Belt Co., executive vp; **C. F. Evers,** Accent-International, vp in charge of activities; **Joseph Czarnecki,** Griffiths Labs, treasurer; and **Col. R. A. Isker,** USA (Ret.), secretary.

• • • Products

Device for determining germination percentage of grain. The Vitascope, manufactured in Copenhagen, Denmark, and now in use in Europe, is being introduced in this country to the grain and seed trade. It provides a rapid method of determining the germination capacity of seeds and grain, tests being accomplished within a few minutes. The Vitascope works on the tetrazolium method. Because testing is under constant temperature and under vacuum, results are obtained quickly. In operation, the embryos of the seeds being tested are exposed, either with a splitting machine, or with crushing tools. When the enzymes in the embryo come in contact with the tetrazolium salt solution, hydrogen is released, turning the germs red. American distributor is the Burrows Equipment Co., 1316 Sherman Ave., Evanston, Ill., who will welcome any inquiries.



FUTURE AACC MEETINGS

In 1965 the AACC will celebrate its 50th anniversary. A special invitation was extended the Association by the Kansas City section. The group wanted the AACC to meet in Kansas City to commemorate the first meeting in 1915. The Board of Directors has accepted this invitation and will hold the AACC's 50th Annual Meeting during the week of April 25 at the Muehlebach Hotel.

The selection of Kansas City for 1965 has necessitated a change in the plans for 1962 (originally scheduled for K.C.). The new site will be St. Louis and the dates, May 13-17. For the benefit of our members we are publishing below a complete listing of our next seven meetings.

City	*Date*
Washington, D.C.	May 3–7, 1959
Chicago	May 1–5, 1960
Dallas	April 9–13, 1961
St. Louis	May 13–17, 1962
Minneapolis	April 28–May 2, 1963
Toronto	April 26–30, 1964
Kansas City, Mo.	April 25–29, 1965

WASHINGTON, D.C., 1959

As most AACC members know, the forthcoming annual meeting will be our first in the nation's capital. The Local Arrangements Committee has been working since the beginning of the year to provide something different for the whole family. They would like to see as many members as possible bring their families to enjoy the wonderful educational and cultural opportunities that no other city but Washington can offer.

There's going to be a recipe contest for the ladies and a real brain teaser for the members. While detailed plans are not yet completed it can be reported that the members will be presented with an interesting challenge to their professional skill as cereal chemists.

It is suggested that you start thinking now about next year's vacation for the family. You'll have the opportunity to increase your professional knowledge and thereby your potential value to your employer while the wife and kids visit one of the world's most beautiful Capitols.

SPACE FEEDING

An interesting development in packaging was recently reported by the ACS's *Chemical and Engineering News*. The story was about U.S. Air Force pilots testing a new way to feed men in space suits at high altitudes. They're using aluminum squeeze tubes filled by the American Can Co. with liquid and semi-solid foods developed by the Quartermaster Food and Container Institute.

Previous methods of high-altitude feeding relied on a gravity system to run food from a can down a plastic tube inserted into the pilot's helmet. Because of pressure differences inside and outside the helmet, air would escape through the tube and blow food out of the can. Needless to say this was far from satisfactory.

The new containers don't depend on gravity, and are unaffected by pressure differences inside and outside the helmet. All the pilot has to do to eat is to squeeze the tube which forces food up through the helmet, and into his mouth.

The new aluminum tubes save considerable weight, 9 grams compared to 48 grams, a fact much appreciated by the engineers. Is the food good? Well, judge for yourself. So far the cans contain things like flavored milks, fruit juices, chicken, beef, and ham. Canco says the results look satisfactory.

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